ELECTRICAL REVIEW
AND
WESTERN ELECTRICIAN

VOL. LVII, No. 17. CHICAGO, SATURDAY, OCTOBER 22, 1910. ISSUED WEEKLY.

BY THE
ELECTRICAL REVIEW PUBLISHING COMPANY

CHARLES W. PRICE, President and Treasurer.
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PUBLICATION OFFICE: MARQUETTE BUILDING, CHICAGO

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SUBSCRIPTIONS.

One Year, United States	$3.00
One Year, Canada	4.00
One Year, Foreign Countries	6.00
Single Copy, 10 cents. Back numbers, beyond one month, each	.25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

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ILLUMINATING ENGINEERING.

Illumination is making rapid progress both as a science and as an art. Until recently it has not been recognized as a separate sphere of activity, and although much attention has been given to illuminating problems by certain individuals it is only recently that the public is coming to recognize this as a distinct profession. There has been, of course, much attention attached to the art of illumination for many years, but with the comparatively recent arousing of interest in this subject much more has been done in a scientific way to solve the problems concerned than was ever done before.

The Illuminating Engineering Society is only three years old, but it is rapidly coming to the front as one of the important engineering societies of the country. It has large problems before it, and its members are showing great energy in attacking these, and thus advancing both the science and the art. The Society itself has shown great enterprise in arranging, in conjunction with Johns Hopkins University, a course of lectures on illuminating engineering which is to be given at the University immediately following the annual convention in Baltimore next week. This series of thirty-six lectures will form a liberal education in the subjects presented, for the best authorities in the various lines involved have been called upon to present the lectures. Among the list may be found college professors, consulting engineers, the scientific men connected with research and testing laboratories, architects and the men engaged in the commercial production of illuminants, lamps, fixtures, etc., indispensable to the application of this art. Unquestionably no such assemblage of authorities connected with this subject has ever before been brought together, and those attending the lectures may be assured that the very latest and most complete information upon illuminating engineering will be presented to them. It is with pleasure that we learn that these lectures are to be published in book form after the completion of the course and thus be made available to the large number of interested persons who will be unable to attend the lectures in person. Such a published collection will constitute the best authority which is available for reference on the subject of illuminating engineering.

Everything at present points to the complete success of the efforts which have been made by the officers of the Illuminating Engineering Society to consummate this unique

supplement to the convention of the Society. The officers of the Society, and especially its president, are to be congratulated upon the happy conception and the efficient realization of this means of supplying a need which was scarcely appreciated until thus brought into prominence. The achievement is noteworthy.

WIRELESS INTERFERENCE.

Newspaper reports record a case of wireless interference which calls for the severest condemnation on the part of all those interested in the use and success of wireless telegraphy. It is reported that one operating company has maintained a sending apparatus whose sole function was to interfere with the receipt of messages of another company, the sending apparatus being intentionally tuned to the frequency used by the competitor and kept in operation so continuously as to make it very hard, if not impossible, to get correct signals at the receiving station. Numerous complaints have been made from time to time against the amateur operators who have so loaded the ether with waves of all lengths that it has been hard sometimes for those engaged in the commercial or scientific use of wireless apparatus to carry on their operations with these interferences. While there may be occasionally malicious interferences of this kind, the operations of the amateurs are usually carried on for either amusement or self-instruction. The instance now brought to light, however, seems to be a deliberate case of malicious interference without any excuse whatever, and it calls much more imperatively for government interference and regulation of the sending out of ether waves than anything which has heretofore occurred. It is to be hoped that public opinion will bring down upon the head of the offender sufficient condemnation to deter anyone else from a similar proceeding, so that governmental supervision will not be necessitated in this field. It is frequently the very ones whose acts precipitate such regulation and control from without that raise the most violent objection to even reasonable restraint and supervision.

THE AMERICAN ELECTRIC RAILWAY ASSOCIATION.

The American Street and Interurban Railway Association, at its convention in Atlantic City last week, changed its name to the American Electric Railway Association. This action is highly commendable, particularly as it was unanimous. It shows that the Association is predominantly a progressive one. In fact, the proceedings of the convention as a whole and of the similar meetings of the last few years show that, as conditions change, the Association is ready to modify its organization, rules and standards in order to keep them abreast of the times.

On December 13, 1882, the Association was organized as the American Street Railway Association. This was some five years before any electric railway had been put into successful commercial operation; the horse was then supreme. Within the next score of years occurred the electrification of street railways and thereby was made possible their extension into suburban and interurban districts. At the convention in 1905 this broadening of the Association's activities was given recognition by expanding its name to what it has been during the last five years. In the last three years the electrification movement has been taken up by several of the steam railroads, and already one of the largest trunk lines of the country has applied for membership in the Association in order that it may profit from its detailed consideration of electric-traction problems.

Urban traction lines are now almost exclusively electric; they are not confined to city streets, but also run above and below them. Therefore the new name of the Association is more suitable for city lines than the old. The interurban lines that are members of the Association are all electric. The steam roads that are electrifying their systems, or parts of them, should belong to the Association. Thus the new name is comprehensive enough to include all who are, or should be, members of the Association. Moreover, it should be gratifying to all electrical men that it marks the beginning of the epoch when all means of land transportation are becoming electric.

SMOKE ABATEMENT.

In a previous issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN we advocated the use of the luminous electric radiator as one means of smoke prevention in our towns and cities, and in this connection a reference to the recent Smoke Abatement Exhibition in Glasgow, Scotland, will be of interest. The Glasgow Corporation Electricity Department took the fullest advantage of the publicity offered and displayed in its "Electric House" a small modern apartment, consisting of three rooms and kitchen, laundry and bathroom, in which all the lighting, heating and cooking were done electrically, and at a cost not beyond the means of the average householder. The manufacturers of various electrical appliances also contributed to make the Smoke Abatement Exhibition almost entirely a distinctly electrical show. The idea is a good one, and may well be copied in this country.

The present season of the year is a good time to drive home the advantages of electricity as a heating agent. The early mornings and late evenings are quite chilly, but during the time that the sun is shining the days are not cold enough to warrant the use of the steam radiators and similar heating appliances in the home. This is where the electric radiator is of especial use. What is easier than to turn on a switch in a bedroom and warm the room temporarily, while dressing, by means of an electric radiator? And the same applies to the kitchen or to the breakfast room. The heat is required in each of these rooms only for half an hour or so in the morning, and by the use of the electric radiator the heat can be turned on instantly just when it is required,

and turned off again just as readily afterward. All of the bother of attending to furnace and the discomfort of being in a cold room until the funace is working properly are thus obviated. There is no smoke or dust or dirt to create a nuisance, and even considering the cost, the electric radiator will compare to advantage under circumstances such as we have outlined above.

SIMPLIFIED RATES.

One of the greatest problems of a central-station company is the establishment of a satisfactory system of rates which will be equitable not only to the company but to the public it serves. One difficulty seems to be the making of a rate schedule that can be easily understood by the consumers, and this fact was admittedly the principal reason of the Municipal Commissioner of Bombay, India, in recommending the substitution of a tariff based on metered consumption in that city in place of the present maximum-demand scale. An examination of the facts of the case seems to show that the bulk of the customers will, if the new scheme goes into effect, have to pay about double the price for electricity for the privilege of understanding the rates. Some few consumers will, of course, pay lower rates, and these naturally have agreed to the change. But there is no doubt but that the meter service will prove a failure, and the Bombay company will doubtless be compelled eventually to resort either to its former method of charging for current or to a similar scheme in which each customer pays proportionately for his share of the station charges, as well as for the actual current he consumes.

THE DOOM OF CRUCIBLE STEEL.

It has been established for some time that the electric furnace is capable of producing a grade of steel quite equal in quality to crucible steel. Formerly the crucible process was recognized as the only available process for obtaining the highest quality of steel. The crucible method is expensive, largely on account of the small quantities of steel which can be handled at one time. In the electric furnace much larger charges can be accommodated, there is less handling involved, and the operation is much cheaper. This is especially true where power can be obtained at a low cost to operate the furnace.

Electric steel furnaces have been installed at various places in this country, and all seem to be meeting with success. In many places the current used has to be generated from steam, and even here where the cost of power is not exceedingly low the process is a recognized commercial success. Where power can be obtained at a very low cost there is no question of the superiority of the electric-furnace method. This is well illustrated in the case of the Hiorth furnace, which was described by Prof. Joseph W. Richards at the recent meeting of the American Electrochemical Society, as chronicled on other pages of this issue. This furnace takes the pig iron from the Swedish blast furnaces, intercepts it on its way to England, purifies it in the electric furnace, and then delivers to Sheffield a steel which is quite as good as any they can produce with the crucible process. This achievement points to the discontinuance of the crucible process of making steel, not only at Sheffield, but at other steel centers.

There may be one exception, however, where the crucible process will still prove advantageous, and this is in the production of certain steel alloys. It is not yet demonstrated that the electric furnace can supply these as advantageously as the crucible process, and it may be that the crucible will hold its own for the production of certain of these alloys.

ELECTRIFICATION OF RAILROAD TERMINALS.

While certain communities are struggling with the problem of how to secure electrification of the railroad terminals in their territory, and while the railroad officials themselves are struggling with the problem of whether such electrification is financially warranted in the case of passenger terminals, where its success is least questionable, news comes that the New York Central & Hudson River Railroad is planning to extend its electrification in New York City to include the freight lines on the west side of Manhattan Island. This progressive corporation seems not only to be satisfied with the success of the passenger lines which have already been electrified, but to believe that it is both feasible and advantageous to use electric motive power in its terminal freight yards.

This example of the attitude assumed by railroad officials who have had direct experience with electrification should go far to convince the officials of other companies, which have not yet taken this step in advance, of the practicability and advantage of electrification. There are undoubtedly large communities where electrification is quite as much in order, and indeed called for, as it was in New York City. There are many other centers which are surrounded with numerous suburbs just as is New York, and where there can be no doubt of the success of electric operation for suburban service at least.

The position taken by the New York Central officials should prove the stimulus to the officials of other roads considering electrification, which they seem to so sorely need.

The main consideration which has caused them to hold back is a financial one. It is considered questionable whether the decreased operating expenses and increased earning power will warrant the additional investment required. The action of the New York Central officials indicates that they regard the financial consideration satisfactory, as on no other ground would such a change be made for freight alone.

CONVENTION OF ELECTRIC VEHICLE ASSOCIATION.

(*Special dispatch to the* ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.)

The Electric Vehicle Association of America held its first annual convention today at Concert Hall, Madison Square Garden, beginning at 10:30 a. m., and continuing until 5:30 p. m. The attendance was large and enthusiastic, over two hundred prominent central-station men, electric-vehicle manufacturers and users being present.

The meeting was called to order by President W. H. Blood, Jr., who expressed the Association's thanks to Arthur Williams, chairman of the Convention Committee, for the careful arrangements which had been made for the Association's first meeting.

The programme was as follows:

Morning Session: President's Address; "Problems Involved in Advancing the Use of Electric Automobiles," W. P. Kennedy, New York; Moving pictures showing the electric vehicle in action, "Recent Electric Automobile Performances," F. L. Dyer, Orange, N. J.; "The Responsibilities of the Central Station to the Electric Vehicle Industry," L. A. Ferguson, Chicago, Ill.; "The Proper and Practical Care of Electric Vehicle Batteries," S. C. Harris, New York.

Afternoon Session: "Various Applications of the Electric Vehicle (Illustrated)," Day Baker, Boston, Mass.; "A Central Station Campaign for Electric Vehicles," F. M. Tait, Dayton, O.; "The Electric Vehicle in Heavy Trucking Service," J. T. Hutchings, Rochester, N. Y.; "Motor Vehicle Road Tests," Mr. Graham, Philadelphia, Pa.; "Philadelphia to Atlantic City—Proposed Run Under Auspices of New York *American*," Duncan Curry; "The Storage Battery," Bruce Ford; "A Modern Electric Garage," Chas. L. Eidlitz.

A novel feature of Mr. Dyer's paper was the presentation of moving pictures, which graphically and humorously portrayed for the first time before an electrical body the advantages of electrically-driven vehicles as compared with those vehicles which are gasoline or horse-drawn. Discussion of the papers was very general. Among those taking prominent part were Messrs. Ferguson, Williams, Ames, Osgood, Searles, Sands, Lloyd and Lund.

A vote of thanks to the New York Edison Company for a luncheon tendered and complimentary tickets to the Electrical Show, which was inspected in the evening, was adopted by the Association.

Railway Signal Association.

An interesting report on electric signaling on electric railways was read before the meeting of the Railway Signal Association, which was held recently at Richmond, Va.

The report dealt with the history of the first installation, a description being given of the system of signaling in use, with the method of control and other points of interest. The report also included sketches of steam roads with alternating-current track circuits, which had been installed in anticipation of the road being electrified.

Tri-Borough Bids Opened.

Bids for the construction, equipment, operation and maintenance of the new Tri-Borough subway system were this week opened by the New York Public Service Commission. The bids for construction alone, by sections, will be opened on October 27.

The cost of construction of this system, which involves a total of about forty-four miles, is estimated at $100,000,000, hence the difficulty of securing private capital to carry on the work.

Hoosac Tunnel Contract Let.

The contract for electrification of the Hoosac tunnel was awarded by the New York, New Haven & Hartford Railroad Company to the Westinghouse Electric & Manufacturing Company of Pittsburg, Pa. This contract is mainly of interest as being the largest contract let this year for the electrification of existing steam lines. It is said that the price of the bid for this work, which includes the electrification of the tunnel, together with the generating plants, is approximately $100,000.

Mill Workers Urge Subway.

The Broad Street subway, which it is proposed to put under the tracks of the Philadelphia & Suburban Elevated Railway Company, is being strongly advocated by many Philadelphians. The employees of a number of mills and factories have as a body recommended the improvements and asked that the necessary franchises be granted.

Illinois State Electric Convention.

As previously announced, the convention of the Illinois Electric Association will take place at Rock Island, Ill., October 25, 26 and 27. Meetings will be held in the Safety Building, the home of the People's Power Company, and exhibits will be displayed in an adjoining room of the same building. The building is located at Third Avenue and Eighteenth Street. An interesting programme is being prepared, and the entertainment features will include a smoker and theater party.

The Illinois Traction Company will run a special car from East St. Louis to Peoria, and the Rock Island Railroad will run one from Peoria to Rock Island. One day of the convention will be devoted to "How to Get New Business." H. E. Chubbuck, the secretary of the association, promises a lively discussion.

The exhibits will be thrown open to the public, and an effort made to interest the citizens of Rock Island and adjoining towns.

The papers at the morning session on Wednesday will be "Signs and Window Lighting," by E. W. Osborn; "The Radical Tendency in Rates," by J. S. Maltman; "Electric Shows in the Smaller Cities," by J. E. Johnson. At the afternoon session there will be papers on "Promoting New Business," by J. P. Pinkard; "How to Get New Business," by Max Heiliger; "New Business Ideas," by O. C. Macy.

On Thursday the papers to be presented are: "Des Moines Plan of Meter Reading," by P. B. Sawyer; "Hunting of Synchronous Apparatus," by Prof. E. J. Berg, "Publicity and Public Policy," by C. W. Lee, of New York.

Officers will be elected at an afternoon executive session, after which a trip will be taken through the Tri-Cities on a special car. The banquet in the evening, tendered by the Peoples Power Company, will take place in the "Black Hawk Watch Tower."

Electric Power in Oil Fields.

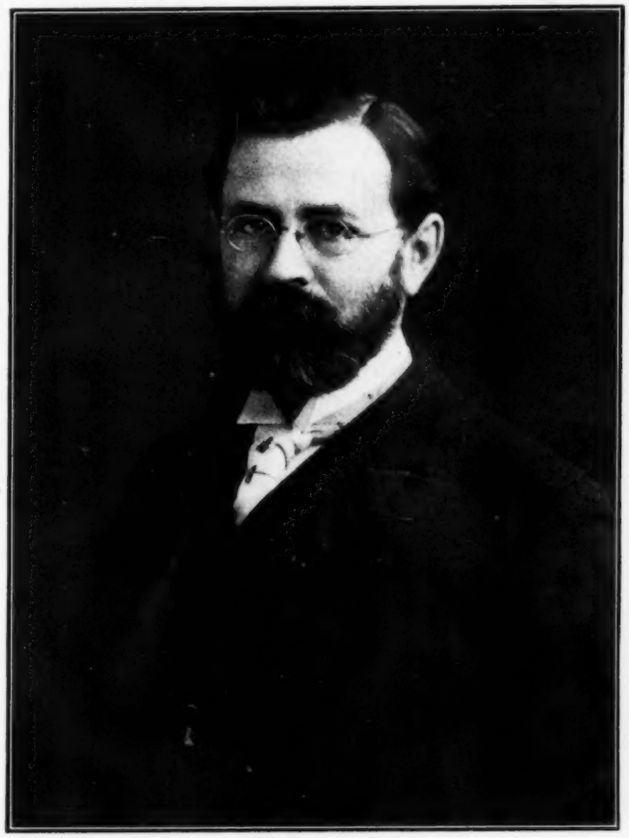
In a few months the power lines of the Big Crane Valley power house of the San Joaquin Power Corporation will be extended to the oil fields near Bakersfield, Cal. One company in the Kern River district has contracted for the use of 200 motors for pumping and other contracts are pending.

Carl Hering.

In this age of specialization it is refreshing to come into contact with a man who is not only interested, but is well informed, in all branches of electrical engineering. The subject of this sketch is a man who takes an active interest in a number of engineering societies, and who has devoted considerable attention to problems connected with a great many phases of electrical engineering and allied subjects. Like many another with original ideas he has not always found it easy to convince his contemporaries of the soundness of these ideas. This is well illustrated in the case of Carl Hering by his suggestion of the desirability of making life tests upon electric lamps at the Philadelphia Electrical Exhibition in 1884. He was, as a young man, a member of the scientific commission for making tests. His ideas on the measurements of lamps were not at first well received by the other members of the commission, but he finally succeeded in impressing upon them the necessity for this action, and since then the life test has continued to be regarded as one of the necessities for judging the value of an incandescent lamp.

Again, when it was sought to make measurements of electric currents of large value and Mr. Hering proposed to make use of the shunt method now so common, the idea was not well received, yet it stands today as the most generally used method of making these measurements. The essential idea was to use a definite resistance with a millivoltmeter or galvanometer to measure the drop of potential through the resistance. This could be calibrated with a small current and then used for the measurement of very large currents without introducing any large resistance in the circuit.

Carl Hering was born in Philadelphia, March 29, 1860. After being graduated from the University of Pennsylvania in 1880, he became instructor in mathematics, engineering and physics. Upon leaving the university he went to Germany and undertook advanced studies in electrical engineering under Professor Kittler at Darmstadt, and later took up practical work with a German firm manufacturing dynamos. In 1883 he represented the Franklin Institute at the International Electrical Exposition in Vienna, and was a member of the jury of awards. He has since served upon similar juries at Philadelphia in 1884 and 1889; at Paris in 1889 and 1900; at St. Louis in 1890 and 1904; at Buffalo in 1901, and at Jamestown in 1907.



CARL HERING,
Consulting Engineer.

For services at Paris in 1889, the French government conferred upon him the decoration of Officier de l'Instruction Publique, and in 1901 he was decorated with the Legion of Honor. In 1891 he headed the American delegation to the International Electrical Congress at Frankfort, and was vice-president of the congress. In 1892 he was for a time editor of the *Electrical World*, and for several years thereafter compiled the weekly digest of current electrical literature published in that journal. He is now a consulting engineer.

Mr. Hering is the author of many valuable papers which have been published in transactions of the various societies and in technical journals, and much of his recent work is concerned with questions connected with the electric furnace. He was the first to call attention to the "pinch" phenomenon and created a very spirited and wide discussion a few years ago by questioning the usual statement of Maxwell's law of electromagnetic induction. He is the author of "The Wiring Computer" and "Conversion Tables" and has given a great deal of attention to the subjects of units of measurement and dimensional equations, one of his latest papers being a compilation of dimensional formulas in the order in which the fundamental units occur.

In recognition of his valuable work Mr. Hering was elected president of the American Institute of Electrical Engineers in 1900 and president of the American Electrochemical Society in 1906, and he is now a vice-president of the latter society. In 1904 he was made president of the Engineers' Club of Philadelphia. He is also a member of the Franklin Institute, honorary member of the New York Electrical Society, and is the American representative of the Société Internationale d'Électriciens.

Mr. Hering has a delightful personality, and has many warm friends among the engineering fraternity, who always find his discussions of scientific and technical subjects valuable and interesting. The diversity of his interest has made him known in all branches of the profession.

Cotton Mill Electrifies.

Recent advices from Charlotte, N. C., state that the Mount Holly Cotton Mills Company of Mount Holly has completed the installation of equipment for driving its plant by electricity instead of steam. The mill is a modern one, containing about 3,000 ring spindles and accompanying equipment for the production of cotton yarns.

THE ELECTRIC VEHICLE.

ADDRESS BEFORE CHICAGO ELECTRIC CLUB.

The electric vehicle is justly being given a position of prominence as a revenue producer by many of the more progressive central stations throughout the country, and the only feasible explanation of the fact that they are not more generally advocated by central stations is perhaps due to a lack of knowledge of the possibilities they offer.

At the regular weekly meeting of the Chicago Electric Club, on Wednesday, October 12, F. J. Newman, works manager for the Woods Motor Vehicle Company, Chicago, delivered a very interesting address on this subject, pointing out that in addition to being a revenue producer for central stations, the electric vehicle compares very favorable with the gasoline car in construction, character of service and dependability.

The speaker first referred to the growth of the electric-vehicle business, calling attention to the increasing number of electrics seen on the streets daily. This growth was probably more strikingly evidenced during the year of 1907, when the electric-vehicle industry was hardly affected by prevailing conditions, while on the other hand, the output of gasoline cars was greatly diminished. The fact that the gasoline car is considered a luxury while the electric car is a utility car for business men, according to the speaker, accounted for these conditions.

The dependability of the electric vehicle was strongly emphasized by Mr. Newman, who said that it is measured by the dependability of the storage battery, the electric motor and the electric controller. Another salient feature brought out by the speaker was the ease with which the electric vehicle may be operated. No chauffeur is required and an electric car may be operated, with entire safety, by any member of the household. The type of tires now being used on electric vehicles also adds to the reliability of this type of conveyance. Mr. Newman said that if the gasoline car is to make a bid for reliability the manufacturers must do away with conditions at present prevailing.

While the electric vehicle is, according to the speaker, entirely reliable for ninety per cent of the service for which power vehicles are designed, namely, city service, he does not, at least at present, advocate the electric for touring.

Mr. Newman referred briefly to the current consumption of the electric vehicle, calling particular attention to the fact that the demand generally comes at the off-peak period. Central stations should, therefore, push off-peak contracts to obtain this remunerative business.

There is a need in the electric-vehicle industry for a device which would combine the functions of several instruments now commonly used and give readings as to the capabilities of vehicle batteries. An instrument of this kind would, according to the speaker, do much toward making the electric car applicable for touring, as the actual mileage of the car would then be known.

Regarding the Edison storage battery Mr. Newman said that he had not formed an opinion as to the merits of this type of battery yet, but he said that he expected lead batteries to make great strides in the future.

Otis B. Duncan opened the discussion, asking Mr. Newman if touring with electric vehicles is not possible in view of the many charging stations scattered about the neighboring country.

Mr. Newman said that touring means high-mileage and this in an electric car depends upon the speed which the car travels, owing to the wind resistance and the type and construction of the tires used. More or less power is required according to the type of tire and those offering the least resistance, consequently extending the mileage capacity, are not suitable for touring.

J. H. Delany asked if the speaker had any figures showing the cost per mile of the electric vehicle as compared with the gasoline car. Replying, Mr. Newman referred to the recent Philadelphia-Atlantic City Reliability Run, which demonstrated the economy of the electric vehicle. An account of this test appeared in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for August 27, 1910, page 441.

Mr. Dulaney also asked how the electric compares with the gasoline car for heavy haulage. Mr. Newman referred to the large equipment of electrics recently purchased by Gimbel Brothers, New York, and said that the economy of this installation led to a similar one at the Gimbel store in Milwaukee. In Milwaukee, however, the weather conditions are so severe that a few of the horse-drawn vehicles have been retained to be used in case of emergencies. The results of the coming winter will probably result in a complete equipment of electrics.

A. A. Gray spoke briefly of the electric vehicle situation in San Francisco. He then interestingly described the work being accomplished in Arizona on the Salt River irrigation project, and in closing paid a high tribute to the electrical interests in the west.

Monazite and Zircon.

Minerals containing thorium are in constant demand for use in making incandesent mantles for gas lamps but only one mineral that carries much thorium—monazite—has thus far been found in quantities large enough to make it commercially valuable. Some specimens of monazite contain as much as twenty per cent of thorium, but the thorium content of commercial monazite, which has been washed and otherwise cleaned, ranges from three to nine per cent.

Brazil and the United States supply the world's demand for monazite, although the greater part of the output of the United States is used in this country. For many years North Carolina and South Carolina have furnished this supply, but important deposits have been lately discovered at several places in Idaho.

The production of monazite concentrates in the United States in 1909 was 541,931 pounds, valued at $65,032.

A report on the production of monazite and zircon in 1909, prepared by D. B. Sterrett, geologist, has just been published by the United States Geological Survey.

Opening of McCall's Ferry Plant.

The power plant of the Pennsylvania Water and Power Company at McCall's Ferry, on the Susquehanna River was formally dedicated and opened on October 14. Mayor Weaver, of York, and Mayor Mahool, of Baltimore, were present.

Power is to be supplied to York, Baltimore and other points in the vicinity. The Consolidated Gas, Electric Light & Power Company, of Baltimore, will be one of the first to receive power.

The Developed High-Tension Network of a General Power System.—II.

A Description of Problems Solved by the Pacific Gas and Electric Company.

BY PAUL M. DOWNING.

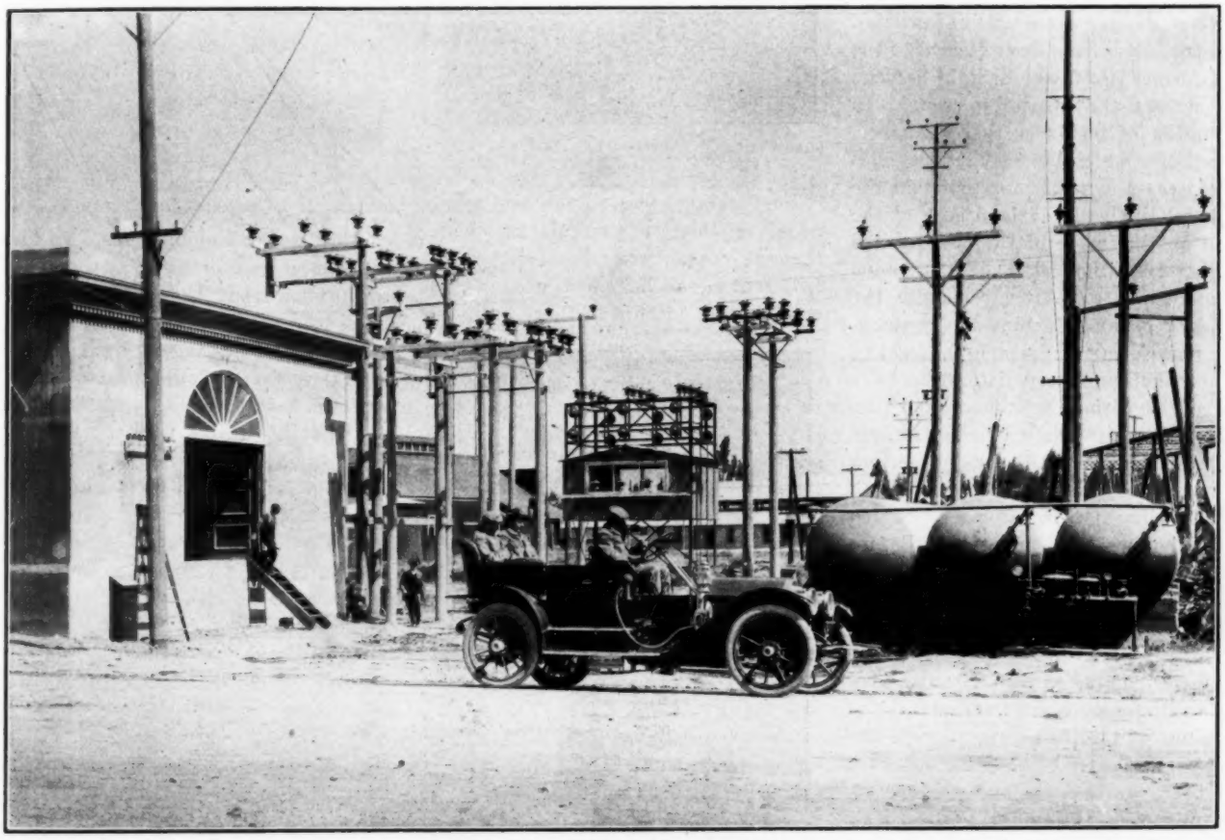
TRANSFORMERS.

The capacities of transformers used range from 100 to 1,500 kilowatts. Most of them, except some of the smaller sizes, are shell type, oil-insulated, and water-cooled. The most satisfactory case for oil-cooled transformers is one of boiler iron mounted on a cast-iron base and having a cast-iron top.

A great deal of discussion has been heard concerning the merits of the different insulating materials used in transformers for high-voltage work, the kind of oil to be used, and the methods of cooling the oil. During the past few years the tendency of the transformer manufacturers has been toward the use of a pressboard or horn fiber for the insulating barriers between the coils, this material being used to replace the micanite used in the earlier transformers. This gives a transformer of lower first cost but one correspondingly less staunch and reliable.

The micanite insulation has two distinct advantages; first, it will not absorb moisture as readily as the pressboard or horn fiber; and second, being noninflammable, it will localize trouble, and a burn-out in one coil, unless it be exceptionally bad, will not damage adjacent coils. Until a few years ago all of the transformers on the system had micanite insulation. They would be received from the factory, and, without attempting to dry them out, they would be filled with oil and put into service. The oil was generally shipped in iron drums containing from fifty to 100 gallons, and when received, it would be put into the transformer without treatment of any kind, and even without being tested to see that it had the proper dielectric strength. The pressboard has superseded the micanite, and the methods of handling transformers have entirely changed. We now find it necessary to dry them out thoroughly even after they have been standing without oil for not more than ten days or two weeks. The oil also is being handled much more carefully than formerly, and separate samples taken from the different tanks in which it is shipped must be tested. If the dielectric strength is found to fall below a certain standard, it is safe to assume that the low insulating qualities are due to moisture, which can be readily removed by heating to a temperature slightly above 212 degrees Fahrenheit.

The pressboard or horn fiber will not only absorb moisture from the atmosphere, but it will, when in direct

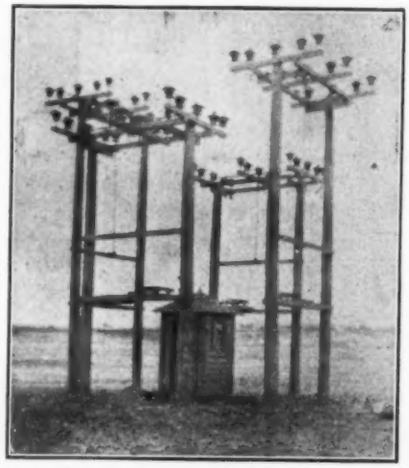


A TYPICAL 750-KILOWATT REINFORCED-CONCRETE SUBSTATION, SHOWING OUTDOOR HORIZONTAL-BREAK AIR SWITCHES AND OUTDOOR OIL-SWITCH HOUSE, TOGETHER WITH BY-PASSING SWITCHES.

contact with water, absorb sufficient of it to allow the layers of fiber making up the sheet to separate, thus rendering it worthless. This objection to its use might on first thought seem hardly worth considering, but in practice it is an important one. In handling transformers out of doors during stormy weather, or in the event of a damaged water coil allowing water to get into the winding, the pressboard would be damaged to such an extent that the transformer would have to be torn down and the barriers replaced.

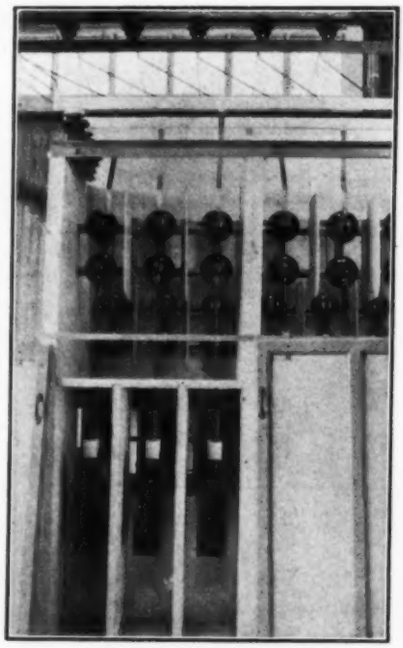
As to the relative fire risks of air-cooled and oil-cooled transformers, I think that it is now generally conceded that the oil type with a properly designed case is the safer of the two. The greatest danger from an oil-insulated transformer is from fire external to the transformer itself, which might damage the case and allow the oil to escape. In a number of instances there have occurred fires which have heated the boiler-iron cases to such an extent that the oil has been badly carbonized and the paint on the inside of the case burned entirely off without damage being done to the winding. After removing the damaged oil and cleaning the winding, the transformers have been refilled with new oil and immediately put back into service without trouble. In one particular instance which I have in mind, a fire occurred in a wooden switch gallery almost directly over a bank of 700-kilowatt transformers which at the time were not in service. Before water could be turned on the fire the transformers had become very hot, and when water was finally turned on, the cast-iron tops had become so hot that the water coming in contact with them damaged them beyond repair. The windings of the transformers were uninjured, and after being dried out were put back into service and are operating today.

From the viewpoint of the man who has to operate the transformer, particularly in connection with long high-voltage lines, I am inclined to question the advisability of attempting to sacrifice the reliability of the transformer in order to cut down the first cost. In the absence of any approved device or apparatus that can be relied upon to take care of high-voltage line disturbances, the transformer must bear this burden to a very great extent, and the breaking down of a transformer with the resulting interruption to service, will, in a very short time more than offset any saving in first cost. For this same reason the three-phase transformer is at a disadvantage, as trouble on one phase would entirely interrupt service, unless a spare were installed.



60,000-VOLT, HORIZONTAL-BREAK, POLE TYPE DISCONNECTING SWITCHES.

For cooling the oil we employ the usual method of circulating water through copper coils immersed in oil. Different metals have been used in these coils, but on account of there being less



DETAILS OF THE 11,000-VOLT SWITCH COMPARTMENT, SHOWING DISCONNECTING SWITCHES ON EACH SIDE OF OIL SWITCH.

liability of copper being acted upon by acids in the cooling water, and also because of the fact that it will not corrode, it has been found most satisfactory. In localities where there is any great amount of mineral in the water, a cooling coil will in time become filled to such an extent that it will not carry a sufficient amount of water to cool the transformer. This deposit closely resembles boiler scale, and in some instances it can be removed by taking the coil out of the case and hammering it on the outside to loosen the scale, after which it can be blown out by either steam or compressed air. In cases where it cannot be removed in this way, we have used dilute muriatic acid as a last resort, but, as this acts upon the metal of the coil, as well as upon the scale, it cannot be considered entirely satisfactory.

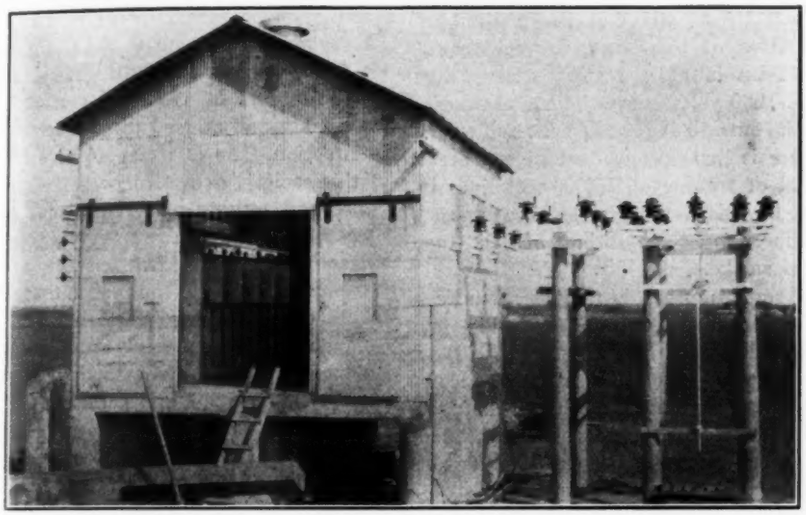
Periodic pressure tests are made on all cooling coils without removing them from the transformers, and very often without taking voltage off the transformer. This we do by disconnecting both ends of the coil and allowing the water in the lower turns to either drain off; or, if both ends of the coil come up over the case, a small rubber hose is inserted on the riser side of the coil and the water siphoned out. To know that the coil is thoroughly dry, and that, in the event of its breaking down under pressure, no water will get into the transformer winding, a light blast of air is passed through the coil, which, with the heat from the oil on the outside of the coil, will in a very short time remove any moisture which might remain. One end of the coil is then plugged and air pressure applied by means of an ordinary automobile tire pump. A small pressure gauge connected to the coil shows the pressure on the coil, and also whether or not there are any leaks which would allow the pressure to drop. Generally, where there is no back pressure on the coils, fifteen to twenty-five pounds will be as high a test as is necessary.

SWITCHES.

Outside of the lightning arrester or line discharger for taking care of high voltages, high-tension switches were probably slower to develop than any other piece of apparatus used in connection with long transmission lines. It is only during the past few years that there have been any high-tension switches on the market, but there are now a number of different designs, all of which have proved generally satisfactory.

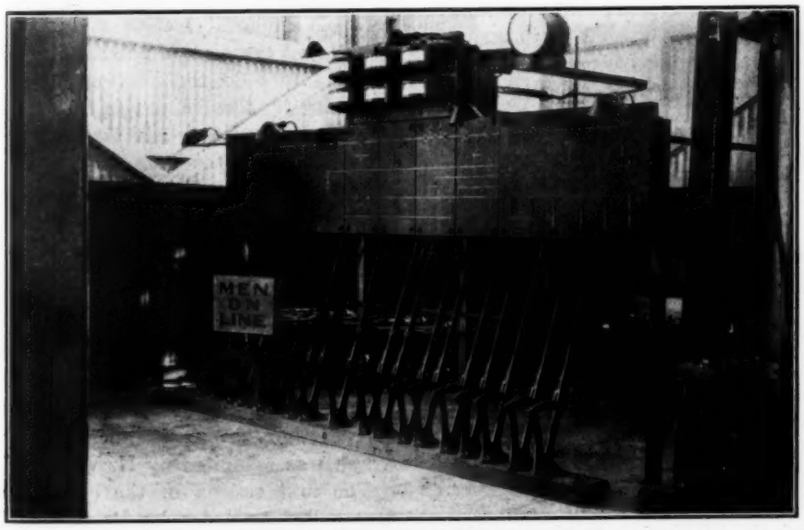
The system of the Pacific Gas & Electric Company was one of the first to use oil switches for voltages in excess

of 40,000. As early as 1900 we built and put into operation switches which were of practically the same type that we are now using. While the switch was in the experimental stages the framework supporting the tanks were



TYPICAL 60,000—11,000-VOLT FIREPROOF SUBSTATION, WITH OUTDOOR DISCONNECTING SWITCH AND OUTDOOR FUSES.

of wood, and the tanks themselves were the ordinary fiber of papier-mâché tubs such as are used for laundry purposes. Switches of this kind served their purposes well, and are even now in use after years of service, but where



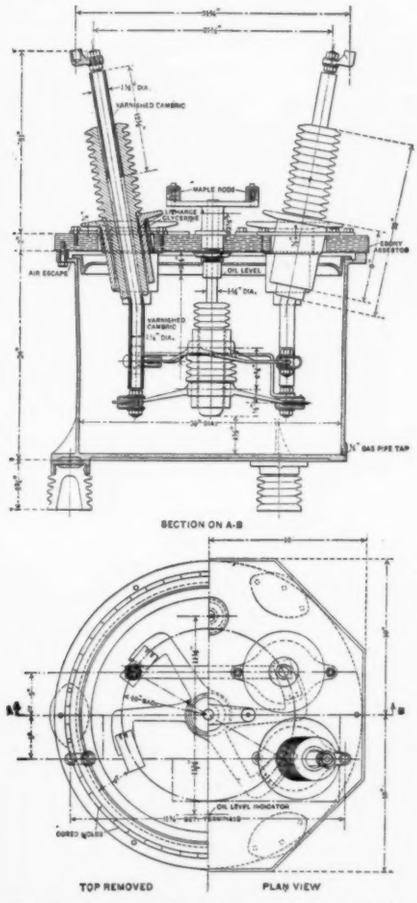
HIGH-TENSION-SWITCH CONTROL LEVERS; LINE AND SWITCH DIAGRAM BOARD; HIGH-TENSION AMMETERS AND SYNCHRONIZER.

they are called upon to break heavy loads, such as come on at times of short circuit, they are apt to throw the oil out of the container when operated.

To overcome this trouble, we designed a four-break switch, along practically the same lines, but with a considerably greater depth of oil over the contacts. Four-break switches similar to the one shown in section and plan in the accompanying illustration have been in service in some of our largest power houses for several years, and they have never failed to open the line under all conditions of short circuit.

The particular features which recommend this switch are: (1) The absence of any insulating material that might become saturated with oil and catch fire either from leakage or from an arc. (2) The insulation of the switch from the ground, thereby affording the greatest protection against breakdowns due to surges or other high-voltage disturbances when the switch is open. (3) A constant depth of oil over the contacts at all positions of the blades. (4) The comparatively small amount of space taken up by the switch.

We have never attempted to operate any of these high-tension switches either automatically or by any electric or pneumatic means, preferring rather to keep to the more positive hand-lever control. This control has generally proven quite satisfactory, but we have just installed some reverse-current relays to be used in connection with the automatic operation of switches on



SECTIONAL ELEVATION AND PLAN OF HIGH-TENSION SWITCH.

lines which are tied together at both ends. We have yet to learn to just what extent these can be successfully employed, on account of the inherent weakness of alternating-current reverse-current relays, whose operation is dependent on both current and voltage, and the fact that in cases of severe trouble the voltage may drop so low that the relay will be inoperative.

LIGHTNING ARRESTERS.

Except in the higher mountain districts the Pacific coast is comparatively

free from lightning, and we make no attempt whatever to protect against lightning disturbances.

On most of the early installations, lightning-arrester apparatus, such as was on the market at the time, was installed at different points along the line. Practically every type of multi-gap arrester was tried, all of which proved to be a menace rather than a protection on account of their arcing over whenever there was a heavy line disturbance. The result has been that long since they have been abandoned, and we now use only the horn-gap type arrester with the air-gap set so that they will arc across on voltages approximately twenty-five per cent above normal. The particular design of arrester used consists of two gaps in series with the ground side, connected directly to earth without resistance.

These are used more on account of their being voltage-limiting devices than on account of their being a protection against high voltages. Discharges over these arresters always cause a drop in voltage, and very often a momentary interruption to service until the arc breaks. We do not install them at every station, but only at the power houses and more important stations where heavy switching is done. The electrolytic arrester now on the market has been installed on some of the lines in this state but, as they have been in service only a short time, little can as yet be said concerning their efficiency or effectiveness.

INSULATORS.

The question of line insulation for the high voltages now being used on transmission lines, is the most serious problem engineers have to face, and, while it is true that both the design and quality of the insulators manufactured today are far superior to those of a few years ago, it is also true that the limiting voltage of a transmission system is governed by the insulators.

The climatic conditions of the greater part of the Pacific coast are peculiar in that there are two seasons, one wet and one dry; and it may seem strange to say that the insulator trouble during the dry season, or just when the first rains start in, is as much as or more than there is during storms occurring in the winter season.

The trouble is due to leakage over the surface of the insulator on account of the dirt and the salt which is deposited by the ocean fogs. As soon as the heavy rains come, this accumulation of dirt, etc., is washed off, and the number of insulator troubles is materially reduced. The number of insulators that actually puncture are very few, the greatest trouble being due to leakage. As a striking illustration of troubles of this kind, I might state that insulators operating successfully at 60,000 volts in the the mountain districts outside of the fog belt, and where there is little or no dust give a great deal of trouble on 11,000-volt lines in the bay district where they are exposed to more severe conditions of dust, fog, and smoke.

Troubles of this kind generally affect insulators on grounded and ungrounded structures differently. If they are supported on poles where the leakage path to ground is a high-resistance one, the top of the pole will be burned off, and generally the insulator is not damaged. But where metallic structures or grounded pins are used, thus giving a low-resistance leakage path to ground, the insulator is more often damaged by the arc, which very often is great enough to burn off the line wire.

Troubles of this kind naturally bring up the question of what design of insulator will best meet the conditions, and whether or not the theory that as much of the insulator as possible should be kept dry is a correct one. This theory has been carried out in the vertical or pin-type insulator with the result that in the three-part and four-part insulators a good portion of the inner petticoat is protected from the rain and cannot be washed by the elements. It therefore becomes necessary to shut down the line and wipe them by hand. This cleaning is especially necessary in the fog district near the bay and along the coast, where it has to be done about twice each year. The suspension insulator has a decided advantage in this respect, in that a much greater part of the surface of the insulator is exposed to the rain and wind, and is washed off during stormy weather. However, with the higher voltages at which this type of insulator is designed to be operated, there is every reason to think that similar troubles will be experienced, and doubtless the same homely means will sooner or later be resorted to in order to overcome them successfully.

AMERICAN ELECTROCHEMICAL SOCIETY.

EIGHTEENTH MEETING HELD AT CHICAGO.

The eighteenth general meeting of the American Electrochemical Society was held in Chicago, October 13, 14 and 15, headquarters being at the Congress Hotel. The arrangements were made by the officers of the local section of the society and seemed to give general satisfaction. As is usual at meetings of this society, delightful weather prevailed and nothing occurred to mar the success of the meeting.

Excursions were arranged for each afternoon of the convention, and these included visits to the Western Electric Company, the Commonwealth Edison Company, the Automatic Electric Company, the Hoskins Manufacturing Company, Union Stock Yards, Chicago Telephone Company, Sears, Roebuck & Company, Illinois Steel Company, Gary Steel Works and Lockport Power Station of the Sanitary District.

On Friday evening a banquet was held at the Congress Hotel. H. B. Coho acted as toastmaster and the principal speech of the evening was made by Robert R. McCormick, president of the Sanitary District, who was the guest of honor. Speeches were also made by some of the officers of the society, members of the local section and others. The New York section extended an invitation to hold the next meeting in that city in April and this will probably be done. Nearly 100 members and guests attended the banquet.

Sessions for the reading of papers were held on Thursday and Friday mornings at the Congress Hotel and on Saturday morning at the University of Chicago. The total registration at the meeting was 210.

An exhibit of pyrometric apparatus was made by the Taylor Instrument Companies, represented by J. A. Sutherland, and the Leitz micro-metallograph was exhibited by H. Vollrath.

The first session of the convention was called to order by President W. H. Walker on Thursday at 10:20 a. m. in the Florentine Room of the Congress Hotel. The first paper to be presented was one by Carl Hering entitled "Method for Determining Thermal Conductivities," an abstract of which follows.

THERMAL CONDUCTIVITIES.

The importance of determining the ther-

mal conductivities of the materials entering into electrical furnaces was discussed and the method proposed is to generate a measured quantity of heat electrically in the center of a furnace, to carry off the heat from the exterior, and, when a steady state has been reached, to measure the temperature inside and outside. It is theoretically preferable to have the specimen in the form of a hollow sphere, but a more practical form is that of a cylindrical cup, round at one end and open at the other. The equations involved, which are similar to those for electrical conductivity under like conditions, were given. It was pointed out that such experiments could be made with any interior and exterior temperatures that may be desired, and that a variation of conductivity with temperature could thus be determined.

The discussion was opened by J. W. Richards, who described his own use of a somewhat similar method of measuring conductivities, which consisted in using a spherical test piece through one diameter of which a hole had been bored. Insulated carbon electrodes were inserted in the two ends of this hole, and an arc was maintained at the center of the sphere. Another radial opening permitted the insertion of a thermal couple which measured the temperature at various distances from the center. This determination of the temperature gradient is sufficient for computing the conductivity. Graphite was found to have such a high conductivity that the fall of temperature was very slight and an accurate measurement could not be made, but the value was higher than any which has yet been published. Amorphous carbon was also used and gave a result similar to those already obtained.

F. T. Snyder spoke of the results obtained at the experiment station of the University of Illinois (Bulletin No. 36) in which a hollow cylindrical specimen was used, and the radial temperature gradient measured for temperatures up to 1,000 degrees.

The next paper was on "Heat Flow Through Furnace Walls" by F. T. Snyder.

HEAT FLOW THROUGH FURNACE WALLS.

This paper pointed out the conditions which determine the flow of heat through the walls of a furnace and the elements which must be kept in mind in furnace design. In the region both inside and outside of the furnace wall, both convection and radiation must be considered, and equations were given for bringing these into the computations. Attention was called to the sudden drop of temperature at the surface of the wall. An example of a calculation with all the necessary corrections was appended.

The discussion was opened by Carl Hering, who spoke of the sudden drop of temperature which takes place at the surface between a hot gas and a neighboring wall. If the thin film of gas which seems to adhere to the surface and form a barrier to the transfer of heat can be broken down the evaporation from a boiler, for instance, can be enormously increased. This is also well illustrated by the high thermal resistance of joints.

J. W. Richards pointed out that the relative insulating properties of different materials of the same form can be determined by temperature measurements of the external surface where this surface is uniform for the different cases, a lower temperature indicating better insulation. On the other hand, with the same materials inside and different forms of surface, the hotter the surface the less the loss of heat. A smooth and bright surface will radiate less than a rough or dark one.

The paper by R. S. Wile, entitled "Reduction of Tin Dross in the Electric Furnace," was, in the absence of the author, read by title only.

A paper by E. Weintraub entitled "Cast Copper of High Electrical Conductivity" was read by A. B. Marvin.

CAST COPPER.

The production in the foundry of pure copper castings mechanically sound and possessing an electrical conductivity comparable to that of pure forged copper has been an important problem ever since the development of electrical machinery and apparatus. The cause of the difficulty of producing sound pure copper castings is well understood. Molten copper has the property of dissolving gases such as oxygen and of setting a part of these gases free on cooling. This produces pin holes and even big cavities. The casting obtained is therefore mechanically unsound and has naturally a low electrical conductivity. These dissolved gases may be eliminated by adding one of the well-known deoxidizers, such as zinc, magnesium or phosphorus, in small quantities to bind the oxygen chemically. Copper castings free from blow holes are thus easily produced, but the electrical conductivity is low, because all the deoxidizers used had also the property of combining with copper and the conductivity of copper drops when small amounts of impurities are alloyed with it. What is needed is a deoxidizer with no affinity for copper. Boron is such a substance and in the form of the suboxide is sufficiently cheap.

It is not necessary that the latter should be pure, but it may be used mixed with magnesium borate and boric anhydride, as obtained in the process of manufacture, for the latter are harmless. In fact, the presence of boric anhydride and magnesium borate is even an advantage as the addition of a larger mass of material makes the operation easier; also the boric anhydride probably dissolves the copper oxide and brings it to the surface as copper borate.

The foundry practice at present is to add one to one and one-half per cent of this mixture, which is equivalent to 0.08 to 0.1 per cent of boron suboxide. The electrical conductivity obtained can be as high as 97.5 per cent if the copper melted down is perfectly pure. In the foundry, where scrap copper is used, a conductivity of 91 to 95 per cent is obtained and a guarantee of ninety per cent is given. The resultant casting is readily machined and takes a good polish. Its tensile strength is 24,350 pounds per square inch; elastic limit, 11,450 pounds; elongation, 48.5 per cent; reduction in area, 74.5 per cent. Castings are being made of all shapes and sizes. Sand and iron molds can be used and the latter are preferred. Cast copper is used in replacing forged copper, with a great saving in cost; and in replacing alloys of copper, where the gain in conductivity allows reduction in bulk and thus a saving in material. The use of this material is spreading as engineers get better acquainted with it and is already of very considerable magnitude. In many cases the effect of higher conductivity is obtained by substituting it for forged copper and eliminating riveted, screwed or soldered joints. The cost of the boron added is not more than 0.75 cent per pound of copper. Samples of the castings were shown.

In the discussion the remarkable increase in the conductivity, which in cast copper is sometimes as low as twenty-five per cent, was mentioned, and it was suggested that the use of boron might be helpful in refining steel.

The next paper by J. W. Richards was entitled "Hiorth Electric Steel Furnace."

HIORTH ELECTRIC FURNACE.

This new type of induction furnace has been set up in Norway adjacent to a water power and is giving good results. The plant generates 1,000 horsepower, of which 500 kilowatts are used in the furnace. The cost of the generating equipment did not exceed $25 per horsepower. The cost of operation, including interest at six per cent and depreciation at five per cent, is about $4 per horsepower per year. A Pelton water wheel is used and the transmission is very short. This furnace was designed to obviate some of the disadvantages of former induction furnaces. The magnetic circuit is of rectangular shape and is fixed in a vertical plane. The bath of molten metal which forms the secondary circuit of the furnace has a middle channel 24 by 8 inches, and two side channels, eight inches square, complete the circuit. The primary circuit is of the same shape as the secondary circuit, and is divided into two parts, one above and one below the secondary. There are in all four coils which are composed of copper bar, and are connected in series. The bath can be tilted for pouring out the molten metal, but after each heat a small amount of the steel is left in the furnace and on cooling this forms a solid figure 8 which gives a closed secondary circuit for starting the next heat, so that no auxiliary heat is necessary. The furnace is operated at a low voltage on 12.5 cycles and the power factor varies between 0.75 and 0.85. The lining of the furnace is magnesite and slag is used simply to cover the surface and prevent oxidation. Dannemore pig and soft iron constitute the raw material and after being treated in the furnace this is cast into ingots and sent on to Sheffield, England. It is found to equal the best crucible steel. About 700 kilowatt-hours per ton of charge suffices and even a less consumption has availed in a number of successive heats. The author also described a number of Swedish installations which he had visited during the past summer.

The first paper at the Friday session was "Notes on Tribo-Luminescence," by W. S. Andrews. The author gave the formula for a mixture which he had found especially suitable for producing luminescence by friction. This

consisted of 70 parts zinc carbonate and 30 parts of flour of sulphur, with a trace of manganese sulphate.

This was followed by "Electrolytic Preparation of Calcium," by A. R. Johnson.

This paper describes experiments made by the author some years ago using electric furnaces of the Borcher type, with current density high enough to melt the deposited metal, and the Rathenau type, where a lower current density is used, and the calcium is deposited as a solid. Calcium chloride formed the electrolyte. Several designs of cell were used and the defects found pointed out by the author. These are stated to be a wrong proportion of the parts of the apparatus, too small distance between electrodes, exposure of the graphite anode vessel to the air thus permitting disintegration, etc. Current efficiencies from 67 to 93 per cent were obtained. The chemical changes in the electrolyte were investigated, and readings taken for plotting curves of decomposition voltage. These indicate a true decomposition voltage of about 2.65 volts.

In the discussion, F. C. Frary stated that the Rathenau apparatus had given good results elsewhere, and attributed the author's failure to the cathode used and poor manipulation. The defects were in the individual apparatus rather than due to the type. He took issue with many of the points raised in the paper and questioned many of the conclusions reached. Decomposition curves had been given by Woehler in 1907 and the results explained. The true decomposition voltage is about 3.2 volts.

Mr. Frary then read a paper by H. R. Bicknell, C. A. Tronson and himself on a similar topic.

EFFICIENCY IN THE ELECTROLYTIC PREPARATION OF CALCIUM.

This paper describes experiments by the author using an apparatus which consisted essentially of a large crucible of Acheson graphite having a water-cooled bottom, and serving as anode. The cathode was of iron about an inch in diameter and was also water-cooled. The crucible was composed of refractory material. The cathode could be raised or lowered by a screw mechanism. Experiments were made with calcium chloride as an electrolyte and also a mixture of calcium chloride and calcium fluoride, but the best results were obtained with the chloride alone. Current efficiencies varying from 45 to 100 per cent were obtained. By gradually raising the cathode the calcium, which first appears in a molten condition, solidifies, and thus forms the cathode. The bath should be worked at a temperature of about 750 degrees. The voltage varied from 18 to 34 in different experiments. Since the theoretical voltage is only 3.2 volts, the watt efficiency may be as low as ten per cent.

A. R. Johnson followed with a paper entitled "Electrochemistry of Polonium and Other Radioactive Elements."

ELECTROCHEMISTRY OF POLONIUM.

This was a preliminary paper relating some of the author's experiences in attempting to electroplate polonium, determine its electrochemical equivalents, etc. The material was prepared according to Boltwood and others. It is less positive than copper or bismuth and more positive than mercury. It is more radioactive than radium. It could be transferred between the electrodes without much loss, but the operation was much slower than with copper, and pointed to an enormous electrochemical equivalent. The researches of others with radium and thorium were mentioned. The quantity of polonium used was very minute, not being enough to show on a balance, and its presence could only be determined by its radioactivity.

In the discussion it was pointed out that a high electrochemical equivalent would be indicated only if nothing else were deposited, and that the slowness of deposit was fully accounted for by the extreme dilution.

A paper by R. D. Small on "The Present Status of Ozone" was then read.

OZONE.

This paper pointed out the rapid development of ozone for purifying purposes since 1903. Forty towns in France use it for purifying the water supply, but the author discussed its use for ventilating purposes more especially. The commercial production usually takes place by means of a brush discharge at 5,000 to 30,000 volts, with a solid dielectric between the electrodes. For electrodes, points are not advantageous, but plates or cylinders are used, stationary or rotating. When liquefied, ozone has a specific gravity of 1.46. It has a remarkable affinity for carbon, and destroys organic matter by oxidizing it. It destroys bacteria only when too concentrated to be safe for man, but prevents their propagation by destruction of their means of sustenance, even when present only in small quantities. Colds are more often due to stuffy rooms than to drafts, and ozone prevents the former. Heat and humidity are unfavorable conditions for its production, and electrodes should be cooled.

"The Evolution of the Lead Storage Battery," by P. G. Salom, was then read.

THE LEAD STORAGE BATTERY.

The author sketched the history and development of the storage battery and described the different methods at present used for the preparation of lead plates. The new Salom type of battery was described. This utilizes a plate in which spongy lead and lead peroxide are first separately prepared, and then compressed under enormous hydraulic pressure into grids to form the plates. The active material is thus welded with the grid into a strong, durable plate which does not shrink nor buckle. The original form of Planté plates are not used nowadays. Faure plates are, however, used where weight is not an important item, as it is in vehicles. The pasted plates are not suitable where length of life is important. The life of the Salom plate is as great as that of the Planté type and has a capacity of two ampere-hours per ounce. The pasted plate loses capacity with service on account of the poor contact resulting from shrinkage. Makers of these plates have mixed various substances such as graphite, pumice, glue, flour, etc., with the paste to prevent shrinkage. The Salom plates have survived treatment that would have ruined other forms of plates.

In the discussion E. A. Sperry pointed out that even with an old type of cell giving only one horsepower-hour for eighty pounds, the storage battery required less weight than compressed air for driving a vehicle, the latter requiring 215 pounds per horsepower-hour.

Carl Hering considered that weight per horsepower-hour is not a just basis for comparing batteries, as life should also be considered, just as with incandescent lamps. A light and cheap battery is preferable to a heavy and longer lived one.

D. M. Hepburn stated that the Salom battery has a weight of 62 pounds per horsepower-hour. Lessened capacity in other batteries is due to the increased resistance occasioned by shrinkage of the button, which then makes poor contact with the plate. When weight is not important a higher capacity can be obtained. The Salom battery gives 10 or 11 watts per pound while 15 watts per pound is claimed for the Edison battery. A high rate of discharge lessens both the capacity and the efficiency. Edward Gudeman thought that figures should be given for capacity per unit volume as well as per unit weight as the former is often quite as important for electric vehicles.

A paper by O. W. Brown and W. G. Bowers entitled "The Self Discharge of Planté and Faure Storage Batteries" was read by Carl Hering.

SELF DISCHARGE OF BATTERIES.

This was a comparison of plates of the Planté and Faure type as regards their behavior under regular use and when left standing. Four makes of batteries were tested: (1) Both plates of the Faure type; (2) both plates of the Planté type; (3) both plates of the Planté type more deeply formed; (4) a Planté positive and a box grid negative. These all had about 100 ampere-hours capacity, and were treated alike. The first was the only one to have the same capacity after fifty cycles as at the start, and it even gained slightly. The loss in numbers 2 and 3 was 13.5 and 7.5 per cent, respectively. The loss in 4 was 2.5 per cent. It was shown that the Planté type continually decreases in capacity. The tests on standing showed that type 1 did not suffer from twenty days on open circuit, but all the others showed deterioration. The conclusions are that the Planté type loses capacity on open circuit, whereas the Faure type loses very slightly or not at all, and the self-discharge is less. The capacity of the Faure type is restored by use, while that of the Planté type is not.

The last paper of the session was by Carl Hambeuchen and was entitled "The Practical Significance of Over-Voltage Phenomena." It was pointed out that good electrolytic contact depended upon this, which explained why tin retained a good contact surface while zinc did not.

The first paper at the Saturday session was by Edward Gudeman, and was entitled "Corrosion of Metal Food Containers—Causes and Prevention."

CORROSION OF FOOD CONTAINERS.

The author discussed the impurities which occur in food products and the federal laws regulating the same. The faults with the ordinary tin plate consists of imperfect continuity and contact. The author has experimented in coating iron with gold, with enamel, etc. The best results have been obtained by coating iron with a thin film of glass. This can be easily done and serves the purpose as well as tin plate. The glass which may be used for this process, however, is lead glass, which is somewhat objectionable. The problem is now being attacked on a commercial scale.

This was followed by a paper by Marcus Ruthenberg entitled "The Electric Furnace and Its Applications." In the absence of the author this was read by Secretary Richards.

ELECTRIC FURNACE.

The first furnace was constructed by Siemens thirty-five years ago. The furnace itself is only a container for the operation performed. Direct current is used only for electrolytic work, whereas alternating current is preferred for heating alone. Large furnace work has been done at constant potential, but it is much better to use a constant-current multiphase circuit. The author advocates using slag as a conductor to save the electrodes and the cooling of the latter. Joints should be avoided as far as possible and conductors made too large rather than too small. Turning to the applications the author called attention to the fact that the smelting of iron ore is now a fact, and he discussed many other smelting operations which can be best accomplished in the electric furnace without previous roasting. The author uses steam-generated current which is furnished at a cost of 0.22 of a cent per kilowatt-hour.

In the discussion F. T. Snyder pointed out that a furnace load was not always considered a desirable load for a central station and it is preferable to have an individual plant for the generation of power.

The next paper was by F. S. MacGregor, entitled "Application of Electrostatic Separation to Ore Dressing."

ELECTROSTATIC SEPARATION OF ORES.

Efforts have been made for some years to utilize the differences in conductivity of the particles of ore for separation in an electrostatic field. This has finally been accomplished and there are two plants now in operation utilizing the Huff separator. In this apparatus there is a series of separators which the ore passes successively, since it is found that a single treatment does not give complete separation. The material is fed from a hopper on a rotating drum which is connected with one terminal of the source of potential. The other electrode faces this, with an air gap of from one to three inches, depending on the material to be separated. The difference of potential is 24,000 volts, which is obtained by first transforming alternating current to this value and then mechanically rectifying at the generator. The current necessary is only about 0.01 amperes. The conducting particles are projected away from the drum and fall into one bin while the non-conducting fall directly beneath the drum in a separate bin. Usually six of these drums are used in one apparatus to secure good separation. The apparatus has proven especially successful in separating zinc from lead ores, as the particles containing zinc are non-conducting. Full details of the process are given.

The next paper, by R. A. Milliken, was entitled "The Isolation of an Ion and a Precision Measurement of Its Charge."

THE ISOLATION OF AN ION AND A PRECISION MEASUREMENT OF ITS CHARGE.

Oil is sprayed through an atomizer so that it can be obtained in minute drops and one of these is admitted into the air space between the horizontal plates of a condenser. The plates are 16 millimeters apart and may be charged to any desired difference of potential up to 12,000 volts. The drops of oil are so small that they almost float in the air, descending very slowly under the action of gravity. The motion of the droplet is observed through a telescope. The drops usually possess an electric charge when first observed, and by creating the electrostatic field the motion can be accelerated, retarded or even reversed according to the strength and direction of the field. The observed velocity serves to determine the charge carried by the particle. This charge is found to vary from time to time due to the acquisition of positive or negative ions from the surrounding air. The changes in charge are found to always consist of a certain definite small quantity or an exact multiple of this and the original charge is invariably an exact multiple of this minimum charge. The author concludes that this minimum charge is the elmentary quantity of electricity and its value is found to be 4.93×10^{-10} in ordinary units of electric quantity. The author concludes that the majority of the ions of ordinary dust-free air, either positive or negative, carry the elementary charge but that some ions carry multiple charges. Interesting confirmation of the kinetic theory of gases was also obtained, and it was found necessary to modify the law of Stokes for the velocity of minute spheres falling in air. The accuracy of the result is at present limited by the uncertainty of our knowledge of the viscosity of the air, but it is considered correct to about 0.2 per cent.

In the absence of the author the paper by J. H. Walton, Jr., "Phenomenon of Crystallization Through Membranes" was abstracted by Professor Kahlenberg. It was shown that while crystallization could be propagated through a membrane of parchment or goldbeater's skin satisfactorily, that this could not be done in the case of indiarubber, except in the case of certain undercooled solutions of organic substances. The author considered that the result depended upon whether the liquid wets the membrane.

This was followed by a paper by Prof. L. Kahlenberg on the "Relative Basicity of Metals as Shown by Their Power to Replace One Another in Chemical Compounds."

RELATIVE BASICITY OF METALS.

It was pointed out that the electromotive series for aqueous solutions does not hold in the case of other solutions. Over sixty others were tried and it was found that the order depended upon the solution. In most cases lead would displace copper from a copper-oleate solution, whereas sodium would not do so even though melted. Nearly all of these solutions are non-conducting and it is shown that the idea of conductivity as being the important feature in these reactions is false. For carbon disulphide, the metals were given in the order of the following series: lead, zinc, bismuth, magnesium, cobalt, tin, iron, aluminum, silver, antimony, nickel, mercury. Sodium was not definitely determined but would come near the end of the series.

In the discussion J. W. Richards pointed out that in aqueous solution the order is the same as for the heat of formation. This work indicates a means of separating the metals by an inverse process to that usually employed. The author replied that little was known about thermo-chemistry except in the case of aqueous solutions.

The next paper, "On the Effect of Water in Causing Chemical Reactions," by David Klein, was, in the absence of the author, presented in abstract by Professor Kahlenberg. In this paper it was shown that the frequent claim that water is necessary to reaction is not true, as fifteen out of twenty-five other substances tried act as effectively as water, and it is evident that electrical activity is not essential.

After a vote of thanks to the various companies which had extended courtesies to the Society, and to the local committee, the meeting adjourned.

Glare Worse than Ultra-violet Rays.

In the course of a special investigation of the effects of artificial light on the eyesight, Professor Gariel, of Paris, somewhat discounts the importance of the ultra-violet rays to which has generally been attributed a particularly injurious influence. As reported in the Engineering Supplement of the *London Times*, Professor Gariel advises the use of yellow glass shades as a means of intercepting the ultra-violet rays of brilliant lamps. In their proportion of these rays he classifies lamps in the following order: Oil, petrol, electric incandescent, gas incandescent, acetylene, mercury arc, and carbon arc.

The general conclusion appears to be that intense glare is more dangerous to the eye than these maligned rays, and the moral is that dazzling points should be so shaded that their light is evenly spread. The same guidance from nature that dissuades people from staring at the sun should warn them to interpose some diffusing medium between their eyes and the intensely bright spots of artificial light that are frequently placed so close to their line of vision.

Ontario Power Inaugural.

The completion of the first section of the Ontario Hydro-Electric Power Commission's high-tension transmission line from Niagara Falls to Berlin was marked by an inaugural celebration and electrical exhibition at Berlin, Ontario, from October 11 to 13, during which the thriving German-Canadian town was electrically *en fete*. The principal streets were literally studded with incandescent bulbs and electric archways heralded the turning on of "hydro power."

The opening ceremonies were held at Auditorium Hall and this building presented a splendid spectacle when Sir James Whitney, Premier of Ontario, assisted by the Hon. Adam Beck, chairman of the Commission, pressed the button and officially ushered in Niagara power. Prominent United States and Canadian manufacturers made exhibits in this building and these were the most attractive feature of the celebration. In the evening a monster banquet was held and attended by over four hundred guests. The complete menu, consisting of eight courses, was prepared with the aid of electric cooking devices.

The history of this Hydro-Electric Power Commission of Ontario dates back approximately ten years and originated with several manufacturers who foresaw the possibilities of obtaining cheap power from the great white coal of Niagara. The movement grew steadily until in June, 1903, the Provincial Government passed an act enabling the construction of municipal power works and the transmission and supply of electrical power. This was followed shortly by the appointment of a commission of five members including Prof. Fessenden, Washington, D. C., Messrs. R. A. Ross and Henry Holgate, Montreal. A very comprehensive report was prepared by this commission and published in March, 1906. In July, 1905, the Hydro-Electric Power Commission of Ontario was incorporated by the Legislature. In 1907 the different municipalities in Western Ontario authorized their councils to arrange for a supply of power from the Hydro-Electric Power Commission. The Commission at this time was composed of Adam Beck, chairman, J. S. Hendrie, W. K. McNaught, with P. W. Southman as chief engineer. They also constitute the personnel of the present Commission.

In view of the fact that there were already three generating companies at Niagara Falls with plenty of power available for sale, it was decided to call tenders for a supply of power rather than construct development works. This was done and a contract was finally entered into with the Ontario Power Company for 100,000 horsepower as required. The Commission has agreed to pay $9.40 per year per horsepower for power at 12,000 volts until 25,000 horsepower are taken and thereafter $9.00 per horsepower for all. A supply of power at 60,000 volts was also provided for in the contract, the rates being $10.40 per horsepower up to 25,000 horsepower and then $10.00 per horsepower for all.

In designing their step-up station equipment, the Commission's engineers arranged for a power supply at 12,000 volts from the Ontario Power Company and this is distributed to the different stations at 110,000 volts and a frequency of twenty-five cycles.

The distribution of power over the extended area the Commission proposed to serve was practically without a parallel and it remained for the engineers to work out a system of distribution to satisfactorily meet the unusual conditions. In this they have been eminently successful and when fully equipped their lines will be as complete as modern practice can make them.

In all, the Commission has erected twelve stations consisting of step-up transformer station at Niagara Falls, step-down transformer station at Toronto, main interswitching station at Dundas, transformer station at St. Thomas, and centerswitching and transformer stations at London, Guelph, Preston, Berlin, Stratford, St. Mary's, Paris and Woodstock.

The opening of the Commission's line to Berlin, important in that it marks the first turning on of this great power, is but the first of a series of similar events for the completion of the entire net work of lines in Western Ontario is not far distant.

During the Berlin inaugural, the Hon. Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, and who may well be termed the father of the power scheme, gave unstinted praise to Chief Engineer P. W. Sothman and his staff of assistant engineers.

Included in the list of engineers employed by the Commission are Messrs. R. A. Ross, Montreal, consulting engineer; P. W. Sothman, chief engineer; F. A. Gaby, chief assistant engineer; H. G. Acres, assistant engineer in charge of hydraulic and transmission-line work; E. T. J. Brandon, assistant engineer in charge of substation work; A. E. Davidson, in charge of substation construction; F. B. Manshendell, insulator expert; P. B. Yates, J. A. Brundidge and F. T. Stocking.

The work of the Hydraulic Department of the Commission has also been of an interesting and valuable character. The different rivers and waterfalls in the Province of Ontario have been guaged and complete and accurate hydraulic data has been collected and tabulated. All this work has been done for the purpose of finding out the actual available power within the Province and will prove of much service for the future.

The zone in which the Hydro-Electric Power Commission is working is not limited to the transmission system in Western Ontario. As far north as Fort William they are selling power to the municipal authorities, while Ottawa in the east is purchasing power from the Commission at much lower rates than was previously possible. Of recent date applications have been received from several municipalities in the Trent Valley District. The demand for cheap power is steadily growing and with it will grow the Hydro-Electric Power Commission of Ontario.

Traction Employees Must Pass Examination.

Beginning September 26 the officials of the Chicago, South Bend and Northern Indiana Railway has conducted a series of written examinations for the motormen and conductors on their lines. With a view of discovering the degree of efficiency among employees these examinations, which have been under consideration for some time, will be made in the office of the general superintendent at South Bend by M. P. Reed, assistant superintendent.

In order to avoid interference with the operation of cars or the running time of the crews schedules have been been adopted so as to permit the men to take the examinations at intervals.

The road has been particularly free from such casualties as those which took place on Indiana lines recently, and the purpose is to further discriminate against the incompetent employee. S.

Street Railway Associations Conventions.

Meeting of the American Association, with the Affiliated Engineering, Transportation and Traffic, Accountants' and Claim Agents' Associations, Atlantic City, N. J., October 10-14, 1910. Report of Papers and Discussions. New Officers. The Manufacturers' Association Exhibit.

The annual meeting of the American Street and Interurban Railway Association, together with the affiliated Accountants', Engineering, Claim Agents' and Transportation and Traffic Associations, was held at Atlantic City, N. J., October 10, 11, 12, 13 and 14. The growing importance of these great organizations was manifestly evident, and it is a matter of congratulation that so great an amount of business was happily carried out. An important feature of the meeting of the parent organization was the changing of the name to the American Electric Railway Association. The meetings of the Engineering Association and the Transportation and Traffic Association were remarkable for the amount of work done. The work of the Engineering Association in respect to its reports of committees on equipment, heavy electric traction, and power distribution was significant of the dependence which the operating man the country over is placing in this important body.

On the following pages there will be found a comprehensive review of the papers, and the discussion before the American Association, the Engineering Association, and the Transportation and Traffic Association.

The Claim Agents' Association held a number of meetings, at which papers specifically relating to this phase of the business were discussed, and the following officers were elected: President, H. V. Drown, general claim agent, Public Service Railway, Newark, N. J. First vice-president, H. K. Bennett, claim agent, Fitchburg & Leominster Street Railway, Fitchburg, Mass. Second vice-president, C. A. Avant, claim agent, Birmingham Railway, Light & Power Company, Birmingham, Ala. Third vice-president, Walter S. Heaton, claim agent, Los Angeles-Pacific Company, Los Angeles, Cal. Secretary and treasurer, B. B. Davis, claim agent, Columbus Railway & Light Company, Columbus, Ohio.

The Accountants' Association held its regular series of meetings, discussing those subjects which appertain particularly to their departments, electing at this meeting the following officers: President, W. H. Forse, treasurer Indiana Union Traction Company; first vice-president, M. R. Boylan, general auditor, Public Service Railway Company; second vice-president, Will Browne, auditor Utah Light & Railway Company; third vice-president, H. E. Smith, comptroller Montreal Street Railway; secretary and treasurer, H. E. Weeks, secretary and treasurer Tri-City Railway Company; executive committee, L. T. Hixson, auditor, Terre Haute, Indianapolis & Eastern Traction Company; F. B. Lasher, traveling auditor, New York State Railways; Charles H. Lehr, auditor Northern Ohio Traction & Light Co.; F. J. Pryor, Jr., auditor American Railways Company.

A fine entertainment program was carried out, the business meeting being interspersed with periods of recreation and relaxation.

American Association.

The meeting was called to order on Tuesday at 2:30 p. m. by President Shaw, who proceeded to read his annual address. Reports were then presented by the executive committee, the secretary, and the committees on subjects, active membership, compensation for carrying United States mail, Brill prize and associate membership.

Frank R. Ford then made an address on "The Theory of Street-Railway Rate Regulation as Developed in the Coney Island Fare Case."

THE CONEY ISLAND FARE QUESTION.

Action was taken before the Public Service Commission to compel reduction of fare from ten cents to five cents by the Coney Island & Brooklyn Railroad Company for transportation from Manhattan to Coney Island, a distance of 11.28 miles. The Commission decided that the tent-cent rate was reasonable. Eighty-five per cent of the traffic is between June and September and most of it on Saturdays, Sundays and houdays in July and August. The peak load is very accentuated. The gross earnings were only 0.89 per cent per passenger-mile for the trip considered. On the entire system, the average ride was between three and four miles and the operating expense between 0.90 cent (four miles) and 1.20 cents (three miles) per passenger-mile. The traffic under consideration is therefore carried at a loss. The outstanding stocks and bonds of the company amount to $8,641,062, all paid in. Prior to electrification, small dividends were paid. Since 1895 the average dividend has been 8.6 per cent. In evaluating the property, no allowance was made for the franchise, which is perpetual. The author evaluated the property in five different ways: (1) earning power; (2) market value of securities; (3) approved capitalization issued; (4) cash investment; (5) cost of reproduction new. These give values between $7,868,162 and $9,299,898, the fifth method giving the largest value.

The discussion was opened by W. J. Clark, who advocated a standing committee to deal with any fare questions that might come up. He was followed by R. P. Stevens, who spoke in favor of a two-cent fare for one-way tickets, 1.75 cents for round-trip tickets and 1.5 cents for mileage tickets.

Mr. Brush told of the experience of a railway system in Massachusetts in raising the fare to six cents to make the property pay and of the commission sustaining the increase. Mr. Sergeant discussed the risks of street-railway investments and the rate of return on the investment, and objected to present physical valuation of the property as a basis for establishing rates. The same view was taken by Mr. Carter, who considered six per cent too low as a maximum dividend, since some years would fall below and at the start many railways do not earn any dividends at all.

Mr. Brady called attention to a decision of the Supreme Court of the United States upholding a valuation in which allowance was made for the fact that a water company was a "going concern," that is, that organization and upbuilding expenses were recognized as part of the investment, although nothing could be allowed for good will.

John I. Beggs also pointed out that there are other things than physical valuation to be taken into consideration, such as the cost of securing franchises, renewal of track, etc. All capital that had actually been paid in should be considered. Funds should also be set aside regularly for reconstruction.

At the Wednesday meeting the report of the committee on Interstate Commerce Commission Affairs was presented by Geo. H. Harries.

A report from the committee on insurance, by H. J. Davies, recommended that the association appoint an insurance expert, that the companies have appraisals of their property made by

independent experts, that each company employ an inspector and give especial attention to the wiring of cars and buildings, that yards be protected by standpipes and that chemical extinguishers be carried in each car.

The committee on Public Relations reported through its chairman, C. L. Allen, that it had accumulated all the acts of state legislatures in force and that a digest would be prepared by a sub-committee and distributed next winter. It is proposed to keep this library up to date.

The report of the Dictionary Committee was made by H. H. Adams. He explained the objects, form and scope of the proposed dictionary and stated that it was nearly ready for the press.

An address on "The Public Side of Street Railroading" was then delivered by Patrick Calhoun. It dealt with the part which railway men should take in political affairs. This was followed by a paper on "The Philadelphia Question" by Charles O. Kruger.

The vote on the amendments to the constitution and by-laws which had been proposed showed that these were carried unanimously, and the name of the association was thereby changed to "American Electric Railway Association."

The proposition to erect a permanent meeting hall at Saratoga Springs was rejected.

The final meeting took place on Thursday afternoon, and opened with the report of the committee on education.

This was followed by papers on "Franchises," by Charles V. Weston; "What Interurban Railway Companies Do for the Public," by Joseph A. McGowan; and "Taxes and Licenses," by Guy E. Tripp.

The following officers were elected: President, Arthur W. Brady; vice-presidents, Thomas N. McCarter, George H. Harries, Charles N. Black, and W. G. Ross. The executive committee is made up of these officers and the presidents of the affiliated societies.

After listening to an address by President-elect Brady and passing several resolutions of thanks, the meeting adjourned.

Engineering Association.

TUESDAY MORNING SESSION.

Acting President W. J. Harvie called the Tuesday morning session of the Engineering Association to order at 10:00 a. m. Before proceeding with the presidential address he made an appreciative reference to Fredick H. Lincoln, chosen last year to be president of the Engineering Association, and to James Heywood, chosen to be chairman of the Power Distribution Committee, who had died during the past year. Condolatory reports were presented and adopted. Mr. Harvie then presented his presidential address, an abstract of which follows:

PRESIDENT HARVEY'S ADDRESS.

Acting President Harvey stated that the Association through its committees had this year performed a very creditable amount of work of improving quality and increasing value. A special mention was made of the good effect of the work done by the Committee on Standards. Two new fields of work had been taken up, by the Committee on Building and Structures, and the Committee on Heavy Electrical Traction. The Association's policy had been broadened so as to include the entire electric-railway field, as instanced by the adding of the Pennsylvania Railroad to the active membership. An invitation to join was likewise extended to all steam roads engaging in electric-railway work. Mr. Harvey announced that requests from member companies for the investigation of specific problems should be in not later than January 1 of the year in which the report is desired, in order to receive proper attention.

The reports of the Executive Committee and of the secretary-treasurer were then presented and approved, whereupon E. O. Ackerman presented the report of the Committee on Way Matters.

REPORT ON WAY MATTERS.

The report of the Committee on Way Matters was prepared by E. O. Ackerman (chairman), Martin Schreiber, M. J. French, J. M. Larned, C. L. Crabbs and George Weston. The subjects treated were as follows: (1) "Specification for Open-Hearth Steel Rails," by J. M. Larned. (2) "Standardization of Girder Rails," by E. O. Ackerman. (3) "Gauge of Track on Curves," by M. J. French. (4) "Rail Joints," by George Weston. (5) "Economical Maintenance," by Martin Schreiber.

Open-Hearth Steel Rails.—Among the very complex specifications for these rails may be noted the following points: Rejection of faulty ingots. Daily chemical analysis of each heat; carbon content not to exceed 0.75 per cent, and not to be lower than 0.60 per cent (desired composition, 0.68 per cent); manganese content not to exceed 0.90 per cent), and not to be lower than 0.60 per cent (desired composition, 0.80 per cent); silicon content not to exceed 0.20 per cent; phosphorus content not to exceed 0.04 per cent. Metal from top of ingot to be discarded. Makers' name, weight of rail, date of manufacture, etc., to be rolled in raised characters on web of rail. Circular holes for splice bars and bonds shall be drilled and for tie rods punched. Weight not to vary more than 0.5 per cent from specification; actual two weights will be paid for. Rails shall be rejected if imperfectly drilled, chipped or filed, but shall be accepted if properly refinished.

Standardization of Girder Rails.—The Committee proposes the seven-inch section weighing 106 pounds per yard. For track special work the seven-inch guard section weighing 122 pounds per yard, and the nine-inch guard section weighing 141 pounds per yard, were recommended. Detailed dimensioned sectional drawings were submitted.

Gauge of Track on Curves.—Various rules were recommended for determining gauge and flangeways of track in curves.

Progress Report on Rail Joints for the Year 1910.—A brief analysis of the subject of rail joints was presented, giving the essentials for obtaining a satisfactory joint, a resumé of past difficulties encountered, and a reference to the different types of joints principally in use. The elements necessary to attain a perfect rail joint were stated to be: (1) The joint should prevent independent motion of rail ends during the life of the rail; (2) the joint should be mechanically strong and should be such that the rail at the joint will be equal in strength and stiffness to the rail itself; (3) the top surfaces of the abutting rails should lie in the same plane. Bolted joints (ordinary and special varieties), welded joints, cast-welded joints, electric welds and Thermit welds, are considered separately in some detail. Maintenance disadvantages, electrical conductivity of joints, opposite versus staggered joints, and an instructive "conclusion," comprise the rest of the report. The following recommendations were made: (1) The necessity is emphasized for thoroughly cleansing joints as by means of wire brushes, files, or, preferably, sand blasting; (2) More care should be exercised in the placing of bolted joints, so as to reduce sledging to a minimum; the use of exceptionally long-handled wrenches should be discontinued; (3) The Committee, while grudgingly permitting a maximum variation of three sixty-fourths of an inch from the template height of rails, as required by the manufacturer, states that there shall be no variation in the fishing dimensions. It further recommends that grinding, or some other means, be adopted to eliminate imperfectly surfaced joints from the finished track, and that the perfectly surfaced joint be made a requirement of ordinary track construction. A special note on the evil effects of joint depreciation recommends that engineers be given ample time to select the most efficient type of joint, and emphasizes the necessity for rigid inspection.

Economical Maintenance.—Mr. Schreiber's paper on this subject is published in full as "Appendix B" to the report, and comprises a fully illustrated text-book of about twenty-eight pages on "The Economical Maintenance of Tracks and Roadways." The treatment is too exhaustive to admit of concise abstracting. The committee gives a long list of conclusions which are set forth in the body of the main report.

There is also an "Appendix A" which is a detailed discussion by J. M. Larned, maintenance-of-way engineer, Pittsburg (Pa.) Railways Company, on the proposed open-hearth rail specifications mentioned in the first part of this abstract.

G. C. Young, discussing the section on steel-rail specifications, called attention to the desirability, in inspection of rails, of holding the chemical composition uniform in each order. He asked the committee whether it were possible to specify the number of passes of the rails through the rolls, inasmuch as he thought a greater number of passes added to the lasting quality of the rails.

C. W. Gennet, Jr., thought it would be unwise to limit the mills to a rolling temperature which it was not sure was the right one.

Several other members spoke on this subject, and finally, on the motion of George Weston, of Chicago, the specifications were adopted, a provisional amendment being subsequently made and accepted to refer the specifications to the Standardization Committee for formal adoption.

The standardization of girder rails was then taken up and exhaustively discussed, many personal experiences being given.

On the motion of M. J. French (car-

ried) the recommendations of the Committee on Standards relating to T-rails were referred to the Committee on Standards and adopted as standard practice.

With regard to the question of gauge on curves, M. J. French stated that some roads adopt a number of different wheel flanges and a number of different truck centers over the same special work, and so there it is impossible to have one flangeway which will suit. The rules which were adopted, it was felt, would govern all cases.

Finally, after some more discussion, the committee's rules were adopted.

In the discussion on rail joints, papers were presented by R. B. Rifenberick and Felix Lang on this subject. Several points of difference to the report were brought out, and George Weston discussed on an Austrian joint which he exhibited and described.

E. O. Ackerman referred to the subject of economical maintenance and noted the committee's recommendations on layouts for track switches, plates and frogs contained in the report.

R. F. Kelker, speaking on the subject of concrete ballast, said that the Chicago practice is to use wet concrete, and that the only method to determine whether the ties are properly tamped is by careful inspection. Referring to storage facilities, he emphasized the necessity of providing a yard equipped with derricks and cranes, the former with clam-shell buckets for handling sand and gravel. These are indispensable in handling a large volume of work. A company can effect a considerable saving by handling its own material with proper equipment, instead of giving this work to outside contractors.

C. H. Clark spoke on economies effected by changing around the men in the gangs, thus eliminating possibilities for favoritism.

John Kirwin gave an account of construction work in Detroit, in which the following standard method was used: putting eight inches of concrete on the sub-grade, allowing it to set for eight or ten days, laying the ties on it, spiking the rail, raising it, and lining it with an inch of sand, and then putting on the rest of the concrete.

C. H. Clark said that Mr. Kirwin's method was used in Cleveland with ill success. He had tried a new scheme this year. He put in seven inches of broken stone under the ties and tamped the ties for ordinary broken-stone construction, and after it was tamped and the surface lined he grouted the whole thing. Then he put the concrete in between the ties and under the rail.

C. B. Voynow said that the important thing in track construction is drainage. He also favored the piece-work system.

John Kirwin gave his experiences in employing men on a sort of piece-work system. He seemed to get better results by employing it.

Finally, on motion of George Weston, this portion of the report was accepted and the committee continued.

TUESDAY AFTERNOON SESSION.

The Tuesday afternoon session was called to order at 3:00 p.m.

The report of the Joint Committee on Shop Accounting was presented by P. S. Young, who read the introduction.

REPORT ON SHOP ACCOUNTING.

The report of the Joint Committee on Shop Accounting was prepared by P. S. Young (co-chairman), A. D. McWhorter (co-chairman), N. E. Stubbs, Charles Hewitt, F. B. Lasher and John Lindall.

Mr. Lindall prepared the report on subdivision of operating expense accounts for electric-railway car-maintenance shops. This classifies the items of (1) passenger and combination cars; (2) freight, express and mail cars; (3) locomotives; (4) service cars; (5) electrical equipment of cars; (6) electrical equipment of locomotives; (7) shop machinery and tools; (8) shop expenses; (9) horses and vehicles; (10) miscellaneous car service supplies, (11) car-house employes, and (12) car-house expenses.

Mr. Hewitt prepared a report on subdivision of operating-expense accounts for electric-railway power plants. This comprises a critical review of the annual reports of the Accountants' Association for some years past, with some new recommendations.

The Subcommittee on Cost Accounting (M. R. Boylan, H. H. Adams, F. B. Lasher), appointed to formulate a system of cost accounting applicable to electric-railay car-repair shops, submitted a report consisting principally of a series of printed cards, order forms, and similar report blanks, etc., suitable for the purpose indicated.

The remainder of the report comprised separate reports on a system for handling scrap material and a method for ascertaining mileage in connection with purchase of supplies on the mileage basis.

E. D. Smith read the section of the paper relating to accounts for power plants.

This was discussed by several of the members, and a letter from James D. Andrews, of Boston, was read.

H. G. Stott noted the omission of the account of obsolesence. Depreciation, he said, is taken care of in the maintenance account.

A discussion on the subdivision of accounts followed, in which Mr. Stott suggested that a portion of the obsolescence be charged against the operating expenses every year.

The shop forms, time tickets, etc., were then discussed in detail, following which the subject of scrap handling was taken up, several methods successfully adopted by various members being explained at length.

The report of the Committee on Power Generation was next presented by Vice-Chairman H. G. Stott.

REPORT ON POWER GENERATION.

The Committee on Power Generation included H. G. Stott (vice-chairman), G. H. Kelsay, C. E. Roehl, J. D. Andrew and E. D. Smith. The following is a list of the subjects considered, with the authors: "Forced Draft," C. E. Roehl; "Flue-Gas Analysis," G. H. Kelsay; "Low-Pressure Steam Turbines," H. G. Stott; "Steam Meters," R. J. S. Pigott; "Peak Loads," H. G. Stott.

Forced Draft in Connection with Boiler Capacity and Economy.—Forced draft is defined as draft produced artificially by increased pressure below the fuel bed, and is regarded as a necessity in cases where low-grade fuel is used. Capacity is fundamentally merely a matter of rate of firing. It is only necessary to get coal into a furnace and burn it to cause the rate of steaming to vary very nearly in proportion to the rate of firing. At present the limitation of the heat-transmitting ability of the metal of the heating surface is not approached, and therefore in large stations economies will result by accelerating the rate of firing by one man in charge of a moderate grate area. Higher steaming capacity usually reduces labor charges and inevitably reduces investment charges. Limiting conditions in regard to air pressure, however, are (1) the blowing of coal from the grate after a critical pressure has been reached, (2) the inability of the lower water tubes to stand the demands made on them, and (3) the rapidly rising and finally prohibitive cost of air supply at extremely high pressure. However, increases of 100, 150, or more per cent, over the present nominal rate of 3.45 pounds of water per hour per square foot, referred to a 650-horsepower Babcock & Wilcox boiler, from and at 212 degrees Fahrenheit, must be brought about. The paper does not regard favorably the CO_2 recorder or the balanced-draft system as a universal panacea for boiler ills, but states rather, that in the last analysis, "The problem of handling forced-draft systems efficiently in railway-power-plant service comes back . . . to that of getting firemen to fire well at the varying rates which are demanded by the varying load." The author predicts that the factors which will result in the most significant advance in forced-draft practice will be (1) the better proportioning of air-ducts and sealed ashpits, (2) the modification of furnaces and boilers to allow the use of higher pressures and gas velocities which are necessary for the utilization of more intensive evaporative rates, and (3) the development of simpler means for the control of efficiency, which leaves at present more to be done in the way of control of firing than in control of the air pressure or draft.

Flue-Gas Analysis.—This is a continuance of work done along this line for two previous years. Inquiries sent out elicited rather disappointing replies, which seemed to indicate rather poor progress. Between the value of continuous and intermittent records, a diversity of opinion exists. It has been proved that a high percentage of CO_2 does not necessarily mean high boiler efficiency; excess CO_2 is quite as important a thing to guard against. A table of bonuses to firemen for CO_2 records was given, ranging from $0.30 a day extra for fifteen per cent CO_2 in the products of combustion for ten hours, to nothing extra for six per cent for ten hours.

Low-Pressure Steam Turbines.—This paper comprised an abstract of tests of three 7,500-kilowatt units in the power house of the Interborough Rapid Transit Company, of New York. The results showed (1) an increase of 100 per cent in maximum capacity of the plant, (2) an increase of 146 per cent in economic capacity of the plants, (3) an average improvement in economy of thirteen per cent over the best high-pressure turbine results, as well as other economies.

Steam Meters.—This paper contains a brief description of various types of steam meters, with remarks on their working, accuracy, etc.

Peak Loads.—Curves were given showing the total maintenance and operating costs per kilowatt-hour for various percentages of load-factor, and also the fixed charges per kilowatt-hour for various load-factors. These curves were adduced to show that for peak loads having an annual load-factor of from five to fifteen per cent, the operating and maintenance charges are relatively unimportant and the fixed or capital charges are of the greatest importance. A few remarks

are appended on (1) storage batteries, (2) purchased power, (3) hydroelectric power (4) gas engines, (5) steam turbines, as sources of power to be considered for peak-load purposes.

At the conclusion of his reading, Mr. Stott said: "With bituminous coal, with forced draft, there is no difficulty in getting 225 per cent rating on the old furnace, which was put in to merely bring the boilers up to 250 per cent. We have been able to get evaporations with force of draft better than before. The explanation seems to be, if you watch the fire, the flame is shorter, with forced draft, and the combustion takes place on the surface of the coal instead of the long-tongued flames which shoot up through the tubes and get chilled, and you have the imperfect combustion. The natural draft of air in filtration through the brick setting of the boiler is a very serious item, and I do not think we realize how serious it is, whereas with forced draft you have a somewhat balanced condition in your furnace."

B. F. Wood suggested that Mr. Stott might have put the figure for fixed charges a little higher than eleven per cent, say up to fifteen per cent. He thought we got a good lesson in forcing from steam locomotives.

G. H. Kelsay said he did not mean to recommend a bonus on CO_2 results, as mentioned in the paper, but only to record the practice of some of the stations. He thought much remained to be done in flue-gas analysis and apparatus to bring it to a practical basis.

Charles Hewitt said he had no difficulty in keeping his CO_2 recorders in working condition.

Mr. Reynolds paid a fine tribute to H. G. Stott for his work in increasing his station capacity and reducing his *per-capita* charges per horsepower. He agreed now with the expressed opinion of an English engineer he knew that the day of the tall chimney was past, although he did not at the time he heard it. He went on to tell in a popular way of the transmission of heat through a plate and quoted Professor Perry, of London, that in order to get the highest efficiency from a boiler the gases must be removed as quickly as possible over the heating surface. Turning to the subject of water power, he explained that the reason this form of power is not useful or practical as a peak-load carrier is the high fixed charges that enter into the problem in this case.

On Mr. Adams' motion further discussion was carried over to the next morning.

WEDNESDAY MORNING SESSION.

President Harvie called the meeting to order at 9:40 a. m. The previous afternoon's discussion was continued.

Professor Mailloux suggested that the principal problem of the boiler economy and efficiency is almost always that of being able to fire well at varying rates. He thought that, under proper firing conditions, the CO_2 percentage is a just and fair measure of boiler efficiency, but under practical conditions it is usually far from being so. One hindrance was damage to boiler grates. He cited examples of this. Another important consideration was that of proper damper control. He pointed out the advisability of establishing a relation between boiler output and draft under normal conditions of fire. The ideal system of control is one which will enable a fireman to be apprised of changes in steam pressure.

William Roberts spoke of the abuse of the exhaust steam turbine, pointing out that it was not appliable in all cases. He moved the acceptance of the report. The motion was carried.

President Harvie at this point read a letter from Secretary-Treasurer John W. Corning announcing that gentleman's resignation.

The report of the Committee on Equipment was presented by Chairman John Lindall.

REPORT ON EQUIPMENT.

The report of the Committee on Equipment was prepared by John Lindall (chairman) H. A. Benedict, M. V. Ayres, R. C. Taylor, Terrence Scullin and A. T. Clark. This report is subdivided as follows:

Car-Body Design.—The first part of this section deals with the elements of design and shows with the aid of simple diagrams the details necessary to be observed in securing strength and stiffness. A paper entitled "Principles of Car-Body Design," comprising thirteen propositions, was submitted to various car builders. Among the replies received the following points may be noted: (1) Steel bodies may be as deficient in stiffness as wooden ones. (2) A car body may easily be made too stiff, to the detriment of its riding qualities. (3) The queen post truss "is one of the best, lightest, cheapest and most effective in all cases, if properly designed." (4) The lightest construction consistent with sufficient strength and stiffness is that in which the entire side between the bottom side sill and the window sill constitutes a plate girder, the plate forming the outside sheathing of the car. (5) The double floor has certain distinct advantages (noted). (6) The propositions on the whole, are generally correct and good. A discussion of means of reducing weight follows, these including (1) increased armature speeds, (2) forced ventilation of motors, (3) the use of fire-proof insulation and the operation of motors at higher temperatures, (4) the use of field control, thereby reducing rheostat weights. Attention is called to the economy in weight made possible by the use of single-ended cars. A discussion on "Two-Motor Equipments *versus* Four-Motor Equipment" is also included.

Rolled-Steel Wheels of Light Design.—A calculation was given to show apparent advantages of the light wheel. The subject is commended to the attention of interested parties.

Proposed Standards for Rolled Steel Wheels.—A letter and detailed drawing, with specifications, from the Carnegie Steel Company, was submitted.

Gauge for Mounting Wheels.—The report states that the gauge as proposed by the 1909 Committee on Equipment could not be used on wheels having different thickness of flanges and while it could be used for checking steel wheels that have been pressed on the axle, it is not convenient for locating the first wheel on the axle for the reason that it would be necessary to have other means of holding the gauge bar parallel with the axle. The report adds that, in the opinion of the Committee, the present general practice of locating the first wheel by gauging from the end of the journal to the hub of the wheel and then locating the second wheel by gauge is more convenient and sufficiently accurate. A detail drawing of a proposed gauge was submitted.

Standard Taper for Pinions.—The Committee approved the recommendation of the 1909 Committee on Standards that the standard taper for pinions be made in the proportion of 1.25 inches in diameter to one foot in length.

Reports on "Gears and Pinions" and "Specifications for Wrought-Iron Bars" are also given.

The parts of the report were read by the various authors and a general discussion ensued, in which the manufacturers were well represented. The various sections were separately referred to the Committee on Standards.

The report of the Committee on Heavy Electric Traction was presented by Chairman J. S. Doyle.

REPORT ON HEAVY ELECTRIC TRACTION.

The report of the Committee on Heavy Electric Traction was submitted by J. S. Doyle (chairman), E. R. Hill, E. B. Katte, W. S. Murray, and J. H. Davis. This included "Specifications for Heat-Treated Steel Axles," "Standard Location for Third-Rail Working Conductors," and a list of terms and definitions pertaining to the latter section.

W. P. Barba, at Mr. Doyle's request, gave a description of the heat-treatment of axles. Several other representatives of the steel companies contributed to the discussion, which was carried over to the afternoon session.

Before adjourning, President Harvie appointed the following Committee on Nominations: J. W. Corning, W. Roberts, G. H. Kelsay, Charles Hewitt, L. W. Jacques, and A. T. Clark.

WEDNESDAY AFTERNOON SESSION.

A discussion of the definitions in the traction report opened the session.

J. S. Doyle explained the attitude of the Association in inducing steam roads to take out membership. He said that the question came up of changing the name of the Association to the American Electric Railway Association, and said this might be done.

In discussing the relations between the Association and the American Society for Testing Materials, Mr. Bostwick, who is a member of the Executive Committee of this society, said the Association could count on the best efforts of the Society for the two bodies to work in harmony with each other.

A motion was adopted to make the necessary advances toward appointment of a joint committee of the Association and the Society to deal with the specifications under consideration, as contained in the traction report.

H. H. Adams stirred up considerable interest in offering for perusal the proofs of an electrical dictionary prepared by Rodney Hill, associate editor of the *Electric Railway Journal.*

Vice-Chairman A. F. Hovey then pre-

sented in outline the report of the Committee on Power Distribution.

REPORT ON POWER DISTRIBUTION.

The report of the Committee on Power Distribution was prepared by A. F. Hovey (vice-chairman), S. L. Foster, E. J. Dunne, E. J. Burdick and William Roberts. This comprised outline specifications for high-tension three-conductor paper cables, specifications for thirty-percent rubber compound, and specifications for paper-insulated underground railway feeders recommended for 1,200 volts or less.

Mr. Hovey pointed out that the cable specifications have been changed somewhat from those of last year. He discussed the report in some detail.

George H. Hill offered a memorandum by Wallace Clark of the General Electric Company in which it was suggested that the conductivity of 98.5 per cent given on page 3 of the specifications was rather high for a guarantee. Other features were also discussed by Mr. Clark in detail.

After a prolonged discussion by others present the paper was accepted and the thanks of the Association tendered to the Committee.

The question of overhead crossings was referred to the Executive Committee after some discussion.

FRIDAY MORNING SESSION.

The first paper considered at the Friday morning session was the report of the Committee on Buildings and Structures. Chairman Martin Schreiber was not present, and so the discussion was opened by E. C. Shaler. The discussion, however, was adjourned and the Question Box was taken up.

QUESTION BOX.

The arrangement of the Question Box is by sections, Power Stations, Track, Car Houses, etc., being covered. The value of the material in this sixty-seven-page pamphlet is much enhanced by reason of the fact that many of the companies have subscribed liberally to the answers, so that the answers to each question represent a consensus of opinion which it would be difficult to attain in any other manner. The pamphlet will be a welcome addition to the files of operating companies.

President Harvie remarked that the discrepancies on some of the answers should lead to a good discussion.

A. Wolff, speaking on boiler economy, said that for good economy the boilers should be kept clean, the settings kept in order, and so forth. Having attended to these details, he had increased the efficiency of his boilers.

William Roberts said he was using a boiler compound just suited to the needs of this boiler, with good results.

Mr. Wood said that cheap fuels necessitated the use of stoking devices that do not clinker. He suggested the use of the underfeed type for this purpose.

A. H. Barker told of a case in which he claims the chemists were able to furnish a boiler compound which, when used with a particularly bad boiler water, caused a flocculent precipitate that could be easily blown out once a day.

D. F. Wood related an experience which was adduced to show that when soda ash is used as a boiler compound it is necessary to have some system of accurately feeding the quantity of soda ash and the amount of water used, and to have a large heater where precipitation can take place, with means for cleaning the heater.

After some discussion on track, the Question Box was put aside, and Martin Schreiber took up the report of the Committee on Buildings and Structures.

REPORT ON BUILDINGS AND STRUCTURES.

The report of the Committee on Buildings and Structures was presented by Martin Schreiber (chairman), G. H. Pegram, F. F. Low, C. H. Clark, T. K. Bell and M. H. Bronsdon. A voluminous paper entitled "Urban and Interurban Terminals," by Martin Schreiber and F. F. Low, comprised the major portion of the printed report, and was subscribed as an appendix. Among other points noted in the report proper, the Committee emphasized the necessity for allowing for reasonable expansion of business in the location of terminals. An interlocking system of signals and switches was recommended in cases where the traffic justified it, and it was pointed out that the capacity of an old terminal may be very considerably increased by such an arrangement. A large central exit was considered desirable. Recommendations for 1911 include (1) economical maintenance, and (2) proper facilities for employees in connection with operating and storage car-house design.

Regarding the installation of toilet conveniences in stations, the consensus of opinion was that these should be discontinued unless an attendant could be used to look after them. Station details were discussed in detail.

The report of the Committee on Standards was read by Secretary Corning.

REPORT ON STANDARDS.

The report of the Committee on Standards was prepared by Paul Winsor (chairman), H. H. Adams, E. O. Ackerman, W. S. Murray, John Lindall, J. H. Hanna, G. W. Palmer, Jr., and Martin Schreiber. Various proposed standard rail sections were given by detailed drawings and specifications. A table of size, weight, length and resistance of copper wires was included in the report. A section of proposed standard grooved trolley wire was also given. In ordering cables, it was recommended to specify by circular-mil dimensions instead of by gauge number, and, in ordering cables of sizes larger than the existing gauge numbers, to specify a standard number of wires of a standard diameter, expressed in thousandths of an inch, instead of ordering by a round number of circular mils. The report concluded with a set of standard specifications for steel axles.

The discussion on this was taken up by sections. Some slight amendments were made, but on the whole the report was adopted as presented.

H. H. Adams hereupon made a presentation of a watch and chain to John W. Corning as an appreciation of his efforts as secretary and on the occasion of his retiring from that position. Mr. Corning replied, and the session adjourned.

FRIDAY AFTERNOON SESSION.

The Friday afternoon session opened with a continuation of the Question Box discussion.

John Lindall said that he believed in a large majority of present-day motors, the grooving of commutators is a great help. He thought that one-sixteenth of an inch should be the limit of variation in distance between armature shaft and gears.

P. V. See said his road had adopted the practice of shrinking on its wheels.

John Lindall said his company used a press and found it successful for this purpose. His road had installed a pressure recorder on the press so as to keep records of pressures for certain fits.

ELECTION OF OFFICERS.

After some general business had been disposed of, the report of the Nominating Committee was taken up.

The following nominations were made:

For president, W. J. Harvie, Syracuse, N. Y.

For first vice-president, E. O. Ackerman, Columbus, Ohio.

For second vice-president, J. S. Doyle, New York.

For third vice-president, Martin Schreiber, Newark, N. J.

For secretary and treasurer, Norman Litchfield, New York.

For members of Executive Committee, John Lindall, E. J. Burdick, G. H. Kelsey and C. B. Voynow.

The secretary was instructed to cast a ballot for the names presented. The motion was carried. President Harvie then addressed a few words to the newly elected officers, and a motion to adjourn was carried.

Transportation and Traffic Association.

The first session of the third annual convention of the American Street and Interurban Railway Transportation and Traffic Association was called to order by President R. I. Todd at 3 p. m. on Monday, October 10. The first topic was the presentation of the annual presidential address.

PRESIDENT'S ADDRESS.

President Todd called attention to the proposed change of the association's name to the American Electric Railway Association, which the officers and executive committee had heartily approved. Two new committees had been appointed, the Committee on Topics and Subjects and the Committee on Construction of Schedules and Time-tables. The adoption of the standard rules on operation of interurban railways and city lines had marked a decided advance in this direction. Conferences with committees of the American Railway Association would still further improve those rules through the experience of the steam railroads. The training of employees so as to promote the public good will is one of the most urgent problems before operating companies.

Reports were submitted by the Exec-

utive Committee and the secretary-treasurer; both were accepted.

J. W. Brown then read the report of the Committee on Passenger Traffic.

COMMITTEE ON PASSENGER TRAFFIC.

The Committee has submitted a series of questions respecting interurban passenger-traffic rates and service to 231 electric railways and in the report the replies were summarized. The greatest number of lines charge two cents a mile or less and only few go above this rate. There have been some increases in rates due to special causes. Nearly half the lines operate limited trains, but only a few charge excess fare for this service. The Committee recommends that the established rate be not less than two cents a mile and above this where construction and operating charges are unusually heavy.

Before discussing this report, John F. Keys, of Detroit, presented his paper on "The Creation of Passenger Traffic."

CREATION OF PASSENGER TRAFFIC.

Mr. Keys explained the very successful advertising methods made use of by the Detroit United Railway which controls about 750 miles of city and interurban lines radiating from Detroit to Toledo, Ann Arbor, Port Huron and many other cities and towns. Folders, time-tables and other literature are freely distributed in hotels and other public places far and near. Car, newspaper and other advertising is resorted to in order to take the city people out to the country and to bring the country folks into the city. The rates are low, service frequent and the traffic has increased remarkably. No excursions are run as limited cars are in daily service.

M. C. Bush opened the discussion of Mr. Keys' paper and the preceding report. He also believes in the policy of not running excursions. They require excessively low rates and increase the liability of accidents and contingent expenses. He would not advise trying to meet the low excursion rates of competing steam roads, as the regular traffic more than keeps the interurbans busy.

D. F. Hegarty said his cars carry advertising of the service on the monitor ventilators so that this is seen day and night.

W. B. Rockwell recommended 1.5 cents a mile as the minimum for regular and profitable service. He does not believe in a railway providing amusement attractions that are not self-sustaining.

G. W. Parker thought that the interurbans have nothing to fear from steam-road competition, but if they are to charge regular rates on Sundays and special holidays plenty of good equipment and frequent limited service must be provided.

J. W. Brown told of the help that newspaper co-operation may be in building up traffic, especially on excursion business. Excursions are all right, if handled in the right way, and they certainly increase the popularity of a road and add indirectly to its profits.

Mr. Brush called attention to what he regarded as a mistake, viz., the agitation of summer business for which special equipment is needed, but used only about 100 days a year. The regular 365-day business should be cultivated by co-operation with manufacturing and commercial interests.

H. C. Page indorsed Mr. Brush's conclusions and said many companies are disposing of their parks and amusement features and are spending less money in advertising the summer traffic. Others who discussed the subject briefly, speaking particularly on the question of parks and advertising, were Messrs. Hathaway, Sylvester, Gome, Snyder, Keys and C. Loomis Allen.

TUESDAY SESSION.

The second session was opened on Tuesday morning. Directly after roll-call the report of the Committee on Interurban Rules was read by C. D. Emmons.

COMMITTEE ON INTERURBAN RULES.

The Committee's report covered over eighty pages, the bulk of which contained the rules recommended for interurban traffic, with definitions of terms and diagrams of signals, specimen train orders, etc. The Committee sent out a ballot to find whether the effort to harmonize the Association's rules adopted at the last convention with those of the American Railway Association (steam railroads) was indorsed by the membership and found that a majority voted against this policy. However, the Committee felt that the advantages of such harmonizing of the rules were so great that the Association should indorse this plan. The interurban rules should also be harmonized with the rules adopted for city roads.

Mr. Wardell opened the discussion on this report. In general he concurred in the Committee's recommendations that co-operation with the rules of the steam roads was highly desirable. The American Railway Association's rules, slightly amended and supplemented by rules needed for special conditions, he thought were entirely satisfactory.

Mr. Rockwell thought it was out of the question to adopt the rules *in toto*. Each road should adopt them as far as possible but be governed by its local conditions. Many of the steam-road rules are absurd in electric-railway practice. He described a lamp marker that he designed for use on each corner of his cars. Mr. McEwen argued against some of Mr. Rockwell's remarks on the need of markers at the rear of the car or train.

A communication was presented from J. A. DuBois, who criticised several of the rules governing the dispatching of trains or cars.

Mr. Pardee took up at some length the reasons assigned by the Committee for submitting an entirely different code from that submitted at Denver last year. These reasons were the desirability of conforming the rules to those of the American Railway Association, but Mr. Pardee thought that the Denver code was already close enough to that of the steam roads. He therefore severely criticised most of the Committee's recommendations for still further conformity with steam roads. The conditions are not at all similar, he said. In fact, strict adherence to the American Railway Association's rules he considered as not conducive to as high a degree of safety as the Denver code. Many serious interurban accidents have happened recently and the Association's rules should therefore be in advance of the requirements that are likely to be laid down by various state railroad commissions. He urged particularly that the running of "extras" and the privileged "right of direction" be prohibited.

The report of the Committee was then taken up in sections for further discussion, which took up almost all the rest of the session. Among the many who made comments on the rules or suggested changes were Messrs. Ault, Brown, Wardell, McEwen, Emmons, Rockwell, Shanahan, Cherry, Collins, Stewart, Mahoney, Hegarty and President Todd.

Mr. Pardee finally moved that the question of amending the Denver code be continued before the Committee on Interurban Rules and that that Committee be requested to confer with the Committee on City Rules and report back at the next convention.

At the suggestion of Past-president Allen this was amended so that the Committee is urged to confer with the similar committee of the American Railway Association, with a view to reconciling the differences between the two associations. The amended motion was carried.

The concluding business of the session was the presentation of the report of the Committee on Express and Freight Traffic, which was read by Mr. Hyman.

EXPRESS AND FREIGHT TRAFFIC.

The Committee, after considerable investigation, failed to find any generally used method of separating earnings and expenses of the express and freight traffic from those of the passenger traffic. As this is highly desirable, it recommended the adoption of a somewhat detailed method of doing this, which could be perfected by conference with the Accountants' Association.

Mr. Watson strongly urged the adoption of the report as it embodies an extremely valuable classification of the express and freight departments's accounts. On motion of Mr. Wardell the report was then accepted.

WEDNESDAY SESSION.

The session on Wednesday morning opened with the appointment of Messrs. Allen, Bolen and Sylvester as a Committee on Nominations.

The report of the Committee on City Rules was then presented by Mr. Hegarty.

CITY RULES.

The Committee recommended a few changes in the code of city rules adopted at the Denver convention. All these changes had been approved by a majority of companies replying to a letter ballot. Seven of the rules were thus affected to a slight extent.

H. C. Page did not consider it advis-

able to amend the rules on apparently trifling points every year. The rules had been adopted and printed by many companies and it was needless expense to reprint them with such slight changes. Mr. Dudley was of the same opinion. Mr. Allen contended that the Committee is a standing committee and the rules cannot be considered as a fixture. They must be amended from time to time to keep them up to date.

The recommended amendments were then taken up one by one. The amended rules as to responsibility and bell signals were rejected and referred back to the Committee. The amended rule as to standing on steps was adopted as was the rule compelling conductors to have a minimum amount of change before leaving the car house. The rule requiring the conductor to stand on the rear platform was rejected. The last rule, that relative to the procedure when power is off the line was rejected. Among those who entered into the discussion of these rules were Messrs. Hegarty, Allen, Duffy, Page, Emmons, Brush, Casey, Cherry, Palmer, Patterson, Larned, Rockwell and Granby.

The code of city rules as amended was finally adopted as the standard code of the Association and referred back to the Committee for further consideration and action and for joint conference with the Committee on Interurban Rules to harmonize any differences in the two codes.

The report of the Committee on Transfer Information was then presented by M. R. Boylan.

TRANSFERS AND TRANSFER INFORMATION.

The report of the Committee covered the various methods made use of by different companies to prevent the misuse of transfer tickets. Considerable information was collected from member companies in reply to questions that were sent out. No general scheme has yet been found to prevent the evil, but the marking of date, exact time and direction of travel on the transfer have a tendency to lessen the trouble.

L. F. Hoffman, of Newark, N. J., also submitted a paper on "Transfer Laws and Suggested Changes."

Mr. Hoffman's paper gave a review of the statute regulations of the transfer privilege in several states and cited court decisions in which the law was interpreted. Only six states and the District of Columbia have laws to prevent fraudulent use of transfers. An outline of such a suggested law was therefore given and the companies urged to secure its passage where no present law existed. A summary of successful crusades against the evil in several cities was also given.

In discussing the paper and report Mr. Brady stated there could be no doubt as to the validity of a strict law against misusing transfers. The giving of free passes is now generally prohibited; the fraudulent use of transfers is along the same line.

Mr. Hegarty told how the help of the city authorities was obtained in Little Rock, Ark. The city shares in the gross receipts. Trading of transfers by the conductors was stopped by compelling them to put them into a sealed box provided with a time stamp.

An extended discussion of the subject was then continued by Messrs. Plummer, Casey, Todd, Larned, Boniford, Hibbard, Cressel and Page. On motion the Committee's report was accepted and Mr. Hoffman's paper ordered published in the Association's proceedings.

THURSDAY SESSION.

The Thursday morning session was to have been opened with a paper on "The Use of Metal Tickets," by George L. Radcliffe, superintendent of the Cleveland Railway Company, but owing to the fact that time was short the reading of the paper was dispensed with. The meeting then passed to the report of the Committee on the Training of Transportation Employees, which follows. Owing to the absence of the chairman, G. O. Nagle, the paper was read by Mr. Warren.

REPORT OF COMMITTEE ON TRAINING EMPLOYEES.

The Committee recommended as a result of its investigation that the work of the Committee of 1911 should include the consideration of a set of forms outlining a standard method of education. The present Committee recommends that the motorman's course should include instruction in company rules and actual car operation, and that this should not be given hastily, as is often the case. At the end of the period of instruction the motorman should be given a period of probation of about a month.

In discussion C. D. Emmons made a few remarks and D. H. Lovell spoke of the methods of training used on the Pennsylvania lines. He remarked that the electric roads had much to learn from the steam roads in the matter of the education of employees. W. H. Collins spoke of the necessity of a course of shop training. The value of such a course is realized in breakdowns, and many delays might be saved if the motorman was a little more of a mechanic. D. H. Lovell, who mentioned a few difficulties incident to adapting steam engineers to the trolley lines, was followed by W. R. W. Griffiths. Mr. Griffiths found that it was extremely difficult to inaugurate a line of promotion, and it was often necessary to take new men and train them in a few days to run a car.

Mr. Palmer, continuing the discussion, dwelt especially on the value of charts and graphic methods in training motormen. The Chicago City Railway Company uses such diagrams to show the operation of the airbrake.

Following the discussion, on the motion of J. N. Shanahan, the report of the Committee was accepted and its work continued for another year.

The next paper, the report of the Committee on Construction of Schedules and Time Tables was, in the absence of N. W. Bolen, read by Secretary Donecker.

While the report purported to be nothing more than a report of progress and a résumé of present practice, some valuable recommendations were made, and the report contained much of interest. On no other thing does the prosperity of a company depend so directly as on the time-table. It is the foundation on which the whole financial structure of the road is built. The public must be pleased, the employees satisfied and yet schedules must be so arranged as to bring adequate profits. The report contains several tabulated methods, reports and time-tables.

A. S. Richey raised questions as to the exact meaning of the words "straight" and "swing run" and "tripper" and "extra" as applied to the making of time-tables. He also made some inquiries as to time-table forms. J. K. Punderford, inquiring further, asked some questions regarding the number of roads using the old string diagram. T. C. Cherry spoke briefly of the form of report used by conductors on his road. J. E. Duffy remarked that while many roads thought they could not stand the expenses of a special man to look after time-tables and schedules, it would be well to work toward that end. C. E. Hubbard, agreed with Mr. Duffy in this and stated his experience in the construction of time-tables.

Mr. Page called attention to the determination of the period of lay-over for any road, saying that this must in every instance be independently decided. Some lay-over, however, is necessary in order that schedules may be maintained, and this the public demands. He also spoke briefly on the method of selecting runs and on summer tripper service. Mr. Bolen then briefly outlined his method of giving out runs.

The value of giving extra runs as a means of holding new men, was the subject of a few remarks by Mr. Palmer. He thought the problem of keeping men with the company worthy of some study.

The report of the Committee was then adopted.

Following the discussion of the paper the changes of the constitution and by-laws in accordance with the new name of the Association were taken up. These changes, as incorporated in the bulletin sent out on August 31, were voted on and adopted.

The report of the Nominating Committee was then read, officers being nominated and elected as follows: President, H. C. Page, Worcester, Mass.; first vice-president, J. N. Shanahan, Baltimore, Md.; second vice-president, C. E. Learned, Boston, Mass.; third vice-president, David Stevens, Cincinnati, O. Members named for the executive committee were: C. D. Emmons, J. B. Sullivan, J. W. Glendenning and A. Gaboury.

After a few remarks by the newly-elected president the convention adjourned.

The Exhibits.

The American Street and Interurban Railway Manufacturers' Association held its annual meeting on Wednesday afternoon. President James F. Shaw of the parent association, made the opening address, in which he felicitated the Manufacturers' Association upon the splendid exhibit, and tendered to it the thanks of the affiliated associations. Remarks were made by President Ellicott and Vice-President Hequembourg. The secretary-treasurer's report showed a balance of approximately $7,000 on hand. A vote of thanks was tendered to the Executive committee and the officers for their work during the past year. The following members of the Executive Committee were elected: C. C. Castle, U. S. Metal & Manufacturing Company, to succeed himself for the unexpired year of the term of office which he was appointed to fill prior to the last election; E. H. Baker, Galena Signal Oil, succeeding O. H. Cutler; H. F. Martin, Pennsylvania Steel Company; W. H. Heulings, Jr., of J. G. Brill Company; E. M. Williams, Sherman-Williams Company, each to succeed himself; E. H. Bluett, American Car & Foundry Company, succeeding A. F. Partridge.

The exhibit of the Manufacturers' Association was one of the most interesting features of the conventon. There were more than 180 manufacturers represented and approximately 70,000 square feet of floor space occupied. Among those participating in the exposition there were the following:

Adams-Bagnall Electric Company, Cleveland made a fine display of regenerative flame arc lamps, enclosed arc lamps for all circuits and accessory apparatus. The company was represented by G. A. Thomson, A. J. Mitchell, E. R. Bryant and R. C. Campbell.

Allis-Chalmers Company, Milwaukee, Wis., exhibited two racks of air-brake equipments, showing straight air and automatic outfits complete; a sectional model of Parsons type steam turbine; a line of street-railway motors and railway controllers; portable and stationary air compressors and numerous photographs of the products of the company. A. H. Whiteside, F. C. Randall, A. P. Peck, C. A. Burns, J. T. Cunningham, E. T. Pardee, Wm. Pestell, St. John Chilton, C. S. Johann, J. B. Nicholson, L. J. Costa, W. B. Spellmire, F. C. Colwell, J. W. Gardner, F. L. Bunton, J. L. Watson, O. C. Ross, J. C. M. Lucas and F. G. Bolles were in attendance.

American Steel & Wire Company, Chicago, Ill., exhibited rail bonds, electric wires and cables, rail-bond tools and the Crown bond tester. The company was represented by B. H. Ryder, J. D. Sutherland, C. J. McGregor, R. K. Sheppard and C. R. Sturdevant.

Archbold-Brady Company, Syracuse, N. Y., exhibited photographs of transmission lines and special crossing towers, catenary bridges and construction, steel work for car shops and heavy transfer tables. W. K. Archbold and C. L. Allen were in attendance.

Baird Electric Company, Chicago, Ill., made a comprehensive display of Baird selective-signal telephone systems for steam and electric railroads; complete central office equipments, with working model of steam and electric railway dispatching lines, dispatcher and ticket office time recorders. The company was represented by A. Moore and A. E. Case.

Bayonet Trolley Harp Company, Springfield, O., exhibited trolley bases with detachable pole clamp; detachable trolley harps; trolley wheels; and sleet cutters. C. S. Olinger and R. A. Garlough were in attendance.

Brown, Harold P., New York, N. Y., exhibited plastic rail bonds; lead-surfaced motor pinions; electrical-contact alloys; "Stay-There" track bolts and "O K" nut locks; motor-car mirrors; and "G P" paint oil. Harold P. Brown, J. Maxwell Coote, William Temple and Albert Temple were in attendance.

Buffalo Foundry & Machine Company, Buffalo, N. Y., showed a line of steam hammers; vacuum drying and impregnating apparatus, heavy castings, vacuum pumps, condensers, etc. The company was represented by E. G. Rippel.

Carbolineum Wood Preserving Company, New York, N. Y., demonstrated Avenarius Carbolineum wood preservative treating methods and exhibited specimens of treated ties, posts and poles. The company was represented by Ralph M. Eisenberg, William E. Graf, Basil Grant, John J. Wessmiller and John N. Schlude.

Chicago Pneumatic Tool Company, Chicago, Ill., exhibited electric drills, electric track drills, grinders, spike-driving apparatus, pneumatic drills and hammers and electrically driven air compressors. The company was represented by Thomas Aldcorn, C. B. Coates, George Barden and Edward Aplin.

Consolidated Car-Heating Company, New York, N. Y., exhibited electric heaters and switches for pressure up to 1,200 volts, door-opening devices, buzzer systems, electric relays, electric resistance tubes, automatic train signals. Cornell S. Hawley, Thomas Farmer, Jr., W. S. Hammond, Jr., and H. L. Hawley were in attendance.

Crocker-Wheeler Company, Ampere, N. J., showed photographic views of railway generators, power transformers, motor-generator sets, etc. Descriptive bulletins of Crocker-Wheeler electric railway apparatus were also distributed. Represented by J. R. Wilson, Rodman Gilder, Clarence E. Delafield.

D. & W. Fuse Company, Providence, R. I., made a fine display of "D. & W." enclosed fuses and safety devices for all electrical circuits, "Deltabeston" magnet wire and field and armature coils particularly adapted for railway motors, arc lamps magnets, heating units, etc. The company was represented by W. S. Sisson, H. F. MacGuyer and H. P. Hinds.

Dearborn Drug & Chemical Works, Chicago, Ill., exhibited scientific treatment for boiler-feed waters, prepared to suit conditions shown by analyses of the waters. Represented by George R. Carr, Grant W. Spear and H. G. McConnaughy.

Dixon, Joseph, Crucible Company, Jersey City, N. J., exhibited lubricating graphite, foundry facings, graphite crucibles, graphite curve grease, graphite wood grease, graphite brushes, pencils, graphite air brake grease, silica-graphite paint, marking crayons, belt dressings, graphite gear grease, graphite car box grease, graphite commutator compound. Represented by J. J. Tucker, J. M. Willitts, J. A. Condit, R. Belleville, H. W. Chase, Wm. McIntosh and L. H. Snyder.

Dossert & Company, Inc., New York, N. Y., exhibited a full line of Dossert connectors; solderless splicing devices; cable taps; two-ways of various types; insulated two-ways and cable taps three-ways; Y's; lugs, front and back connected angle and swivel; stud connectors, cable anchor equalizers, grounding devices; and third-rail jumpers. The company was represented by H. B. Logan and S. A. Jenkins.

Edison Storage Battery Company, West Orange, N. J., exhibited Edison storage battery in detail. The company was represented by D. C. Arlington.

Electric Omnibus & Truck Company, New York, N. Y., showed field electric omnibuses operated with the Edison storage battery shown in operation on the street in front of the Exhibit Hall, starting each hour. Represented by C. J. Field, R. C. Cilley, C. W. Hussey, W. C. Seaman, V. E. Daniels.

Electric Service Supplies Company, Philadelphia, Pa., exhibited Garton-Daniels lightning arresters, choke coils and grounding devices; Lyon steel gear cases; "Keystone" overhead materials, block signals, sand traps, leakless valves, trailer connectors, railway telephones, lamp guards and porch light fixtures; "Protected" rail bonds and bonding tools; "International" fare registers; "Samson" bell and register cord; "Lock-On" controller handle; "Peerless" tension and banding machines; Locke insulators. The company was represented by Charles J. Mayer, J. W. Porter, J. V. E. Titus, A. H. Englund, M. A. Berg, E. R. Mason, T. C. Brown, R. D. Brown, W. A. Armstrong, Jr., F. A. Strail, G. E. Watts, G. W. Cox. A. F. Paul, F. C. Peck, H. G. Lewis, J. R. McFarlin, H. Hellyer, T. H. Henkle, W. D. Hamer, N. P. Hall, F. H. Jamison, R. Montgomery and G. Miller.

Electric Storage Battery Company, Philadelphia, Pa., showed a street-railway switchboard panel with new average adjuster; illustration of new oil insulator for batteries in leadlined tank; sample of positive and negative plates; details of storage battery apparatus. Represented by Charles Blizard, G. H. Atkin, H. B. Gay and Edward L. Reynolds.

Garwood Electric Company, Garwood, N. J., showed an electric welding outfit. Represented by George Hill.

General Electric Company, Schenectady, N. Y., exhibited a 100-kilowatt, sixty-cycle Curtis steam turbine unit operating at 3,600 revolutions per minute. This machine is of the horizontal type and is of particular interest, as it embodies the general features of design and construction employed in the larger sized units of this type. Apparatus for high-tension direct-current railways shown included a complete type "M" control equipment suitably mounted on rack to exhibit its operation and method of installation. A 600/1,200-volt railway motor was shown with this equipment. This motor rates at fifty horsepower and is of the box frame commutating pole type. A 400 kilowatt 1,200-volt direct-current rotary converter panel of latest design was also shown. The Company also exhibited a complete emergency straight air brake equipment for both motor car and trail car with "CP-27" air compressor, the air compressor being provided with a glass cover in order to show the superior lubricating system in operation; two-motor car equipments of the electro-air brake system including CP-28 air compressors; several of the latest types of railway motors, including the form "A" box-frame railway motor, rated forty horsepower at 500 volts; GE-214 box frame commutating pole railway motor rated at seventy-five horsepower on 600 volts; GE-219B., split frame, commutating pole railway motor, rated fifty horsepower on 600 volts, and a complete line of the company's railway line material and rail bonds mounted on special exhibition boards. Among the smaller apparatus included in the exhibit was a recording steam and air flow meter, an indicating steam meter, a magnetite arc headlight, latest types of switches, rheostats, motorman's valves, etc. Among the

representatives present were J. G. Barry, W. J. Clark, W. B. Potter, C. C. Pierce, S. W. Trawick, R. E. Moore, E. H. Ginn, H. S. Monroe, G. D. Rosenthal, H. C. Marsh, R. J. Cash, H. M. Winter, H. C. Glaze, F. E. Case, E. D. Priest, G. H. Hill, W. G. Carey and Frank H. Gale.

Gold Car Heating & Lighting Company, New York, N. Y., exhibited electric heaters and car ventilators. Represented by Edward E. Gold, E. B. Wilson, J. M. Stayman, F. H. Smith and F. Cahill.

Gould Storage Battery Company showed a car at the entrance of pier equipped with 58 type T-H-29 storage cells. At booth, grids and batteries and photos of Detroit River tunnel installation were shown. Represented by Dr. W. E. Winship, W. S. Gould, G. C. Hayes, Fred Booss.

Heany Fire-Proof Wire Company, New York, N. Y., showed fireproof asbestos covered insulated wire and coils for armatures and fields; Heany Lamp Company's lamps (tungstens). The company was represented by R. K. Dana, Frank A. Duff and Edward Bond.

Jeandron, W. J., New York, N. Y., exhibited electric railway motors and generator carbon brushes. Represented by W. J. Jeandron.

H. W. Johns-Manville Company, New York, showed many new and interesting devices in addition to its already large line of electric railway equipment. The latest developments in "Noark" car-fuse boxes, designed for 600 volts, and in capacity of from 100 to 400 amperes, occupied a prominent place in the exhibit. These boxes were arranged to take National Electrical Code standard fuses. J-M insulators, for all classes of service up to as high as 100,000 volts, were represented by a very complete line. J-M porcelain insulators, in both petticoat and disc types, together with pins, fittings, etc., for long distance transmission systems, were another item of interest. J-M fiber conduit, together with a complete line of fittings, tees, elbows, crosses, etc., formed a central feature of the company's exhibit. This is a conduit of moulded construction. The walls are three-eighths inch thick and the material is moulded under such heavy pressure as that there is no possibility of warping, splitting or cracking of the sections. J-M fiber oil-switch tanks were shown in a variety of shapes and sizes. These tanks are made to meet an increasing demand as containers for oil switches and circuit breakers of capacities up to 60,000 volts. J-M Transite asbestos wood for fireproofing cars, power houses, etc., was well represented. This material has very nigh fire-resisting and electrical insulating properties and can be worked and grained as easily as wood. J-M ebony asbestos wood, which has come in such general use for panel and switchboards, was shown in a variety of finishes and sizes. There was also an extensive exhibit of the company's moulded insulation for power houses and electric trolley car apparatus, such as moulded mica, Electrobestos, Vulcabeston, also J-M linolite illuminating devices, J-M friction tape and splicing compound, J-M dry cell batteries, etc. The following were in attendance: J. W. Perry, G. A. Saylor, H. M. Frantz, R. R. Braggins, E. B. Hatch, R. C. Buell, A. E. Brown, R. R. Lattin, R. C. Cole, A. G. Newton, W. H. Robinson and Geo. Christensen.

Lagonda Manufacturing Company, Springfield, Ohio, showed Weinland tube cleaners, air, steam, water and electric driven; Lagonda automatic cut-off valves; tube cutters; reseating machines; Lagonda-Enterprise Multiple strainers. Represented by J. P. Maloy, J. H. Johnson and Hart Hill.

Leeds & Northrup Company, Philadelphia, Pa., showed Herrick inspection test sets; Wheatstone bridges and other resistance measuring apparatus; standardization apparatus; galvanometers; cable testing apparatus; resistance thermometers and pyrometers. Represented by C. S. Reeding.

Lord Manufacturing Company, New York, N. Y., made an elaborate display of flaming arc lamps, controlators, Bradshaw car skids, Lord lightning arresters, rail bonds, Earll trolley retrievers and trolley catchers, etc. The company was represented by W. R. Garton.

McVicker, W. B. Company, New York, N. Y., exhibited scientific boiler compounds, hydraulic elevator compounds, high grade lubricants, odorless disinfectants and cleansing powders. W. B. McVicker and C. W. Dean were in attendance.

Massachusetts Chemical Company, Boston, Mass., made a comprehensive display of rubber and liquid insulating materials. There was also shown Walpole and other friction tapes, Neponset splicing compounds and all kinds of mechanical rubber molded specialties. The company was represented by Louis O. Duclos, Arthur E. Duclos and E. W. Furbush.

Morris, Elmer P. & Company, New York, N. Y., maintained an interesting exhibit at which was shown standard ornamental lighting and electric railway service iron poles with ornamental fixtures and brackets attached; also ornamental cast-ion seats and flower stands for parks; standard overhead material and various other specialties handled by the company. Elmer P. Morris, M. R. Jarvis, Dwight E. Morris, C. H. Lambkin and T. H. Cowden were in attendance.

National Carbon Company, Cleveland, O., displayed a full line of its Laclede carbon brushes. A single set of these brushes has a mileage record of 500,000 miles. There was also shown a full line of arc light carbons and batteries. The company was represented by D. D. Dickey, W. B. Brady, F. D. Kathe, O. T. Weaver, T. M. McNiece, E. H. Martindale and A. C. Henry.

Ohio Brass Company, Mansfield, Ohio, exhibited trolley fixtures, catenary materials, rail bonds, porcelain insulation, Tomlinson automatic and M. C. B. couplers, "O. B." diaphragm sanders and whistle valves, "O. B." trolley retrievers, luminous arc headlights and electric car-signal systems. C. K. King, E. F. Wickwire, J. R. Brown, C. H. Thomlinson, N. M. Garland, A. L. Wilkinson, A. L. Price, W. C. Starkey, G. E. Willis, J. E. Slimp, W. H. Bloss, Nathan Shute, Frank V. Cook, R. J. Deneen and E. C. Brown are in attendance.

Philadelphia Electrical & Manufacturing Company, Philadelphia, Pa., exhibited tungsten arc lamps, street-lighting fixtures, malleable-line material of all kinds, trolley-wire splicing sleeves, open-circuit detectors, etc. The company was represented by C. L. Bundy and W. O. Dale.

Rail Joint Company, New York, N. Y., showed a line of Weber, Continuous and Wolhaupter rail joints. L. F. Braine, Mr. McCaskey, W. A. Chapman, E. A. Condit, P. Holbrook, G. W. Smith, W. E. Clark and H. C. Holloway were in attendance.

Roeblings' Sons Company, Trenton, N. J., exhibited bare wire, wire rope and fittings, wire cloth and netting, insulated electrical wires, cables. Represented by W. P. Bowman, A. B. Conover, U. G. Tingley, M. R. Cockey, G. R. Swan, W. L. Doyle, A. D. Clarkson and A. V. Errickson.

Speer Carbon Company, St. Marys, Pa., showed carbon brushes, railway motor, generator and stationary motor brushes. J. S. Speer, G. P. Fryling and A. Mullhaupt were in attendance.

Standard Paint Company, New York, N. Y., showed P. & B. and S. P. C. insulation varnishes, compounds and tape; "Flexite" and other preservative paints. Charles E. Smith, H. A. Inwood and H. E. Lavelle were in attendance.

Standard Underground Cable Company, Pittsburg, Pa., exhibited lead covered and armored power cables; bare and insulated wires; "Colonial" copper clad wire; trolley wire; Davis open air and station terminals; manhole junction boxes; cable joining materials. The company was represented by C. J. Marsh, G. L. Wiley, H. P. Kimball, R. S. Hopkins, T. E. Hughes, R. M. Hirst, S. S. Warner, J. R. Wiley, E. J. Pietzcker, J. H. Lytle, R. B. Wilcox and C. A. Brown.

Sterling Varnish Company, Pittsburg, Pa., exhibited insulating varnishes, iron enamel paints, raw refined linseed oil, tank for dipping car fenders. Represented by A. S. King, W. V. Whitfield, W. F. Hebard.

Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., showed dispatchers' signal system; iron-clad dispatching telephones; street railway portable telephones, test sets; jack boxes; local and common battery private branch exchange switchboards; flush type and non-flush type wall and desk automatic key type intercommunicating telephones. Represented by J. O. Oliver, C. E. Hagues, E. P. Ellis, C. P. Button, H. C. Slemin.

United States Electric Signal Company, West Newton, Mass., showed automatic block signal, automatic block recording signal, highway crossing signal; "Usesco" rail sander. Represented by Roland F. Gammons, second; John J. Ruddick, William W. Harrington, J. Warren Putman.

Westinghouse, Church, Kerr & Company, New York, N. Y., distributed copies of its book entitled "Work Done."

Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., exhibited a complete line of railway motors, controllers, circuit-breakers and repair parts. The company was represented by S. L. Nicholson, C. S. Cook, C. H. Davis, M. B. Lambert, J. J. Sinclair, W. J. Conwell, Thomas Cooper, H. C. Stier and J. C. McQuiston.

Westinghouse Lamp Company, Bloomfield, N. J., incandescent lamps, including carbon, tantalum and wire-type tungsten lamps. The company was represented by Walter Cary, T. G. Whaling and B. F. Fisher.

Westinghouse Machine Company, Pittsburg, Pa., exhibited a Le Blanc condenser, complete with turbine motor and air pumps. E. H. Sniffim, H. Van Blarcom, L. L. Brunsmade and H. P. Childs were in attendance.

Westinghouse Traction Brake Company, Wilmerding, Pa., made an elaborate display of electro-pneumatic brakes, automatic brakes, electric-pump governors, automatic car and air couplers, and motor-driven air compressors. The company was represented by A. L. Humphrey, W. V. Turner, W. S. Bartholomew, J. R. Ellicott, E. L. Adreon, E. A. Craig, R. P. Noble, H. S. Clark, P. H. Donovan and R. E. Adreon.

Western Electric Company, New York, N. Y., exhibited an extensive variety of equipment for electric railways. An attractive line of railway telephones, car equipment material and overhead line material was also shown. The apparatus shown included telephone sets of many descriptions, including portable telephones and Interphone sets, transmitters and receivers, selectors, relays, coils, condensers, transmitter arms, line poles and jacks, protectors, batteries, bells and buzzers. The car equipment material included commutators, registers, trolley poles, car wheels, headlights, gongs and bells, high-tension switches, Hawthorn soldering salts and paste. In the line material exhibits were trolley frogs, crossings, strain insulators, Electrose material of many kinds, mounted on display boards and high-tension insulators. Hawthorn flaming arcs and a line of incandescent lamps were also shown. In attendance at the exhibit were F. D. Killion, J. L. Ludwig, W. R. Lyall, D. C. Guest, R. P. Miller, M. A. Oberlander, E. D. Himan, H. B. Sullivan and R. H. Harper.

Yale & Towne Manufacturing Company, New York, N. Y., displayed a full line of its electric hoists, carrying trolleys, chain blocks, and cranes. C. W. Beaver, H. C. Spaulding and R. T. Hodgkins were in attendance.

New York Electrical Show.

The fourth annual New York Electrical Show held at Madison Square Garden, New York City, was brought to a fitting close on Thursday, October 20, after a most successful exposition covering a period of ten days.

The exhibits were all of a comprehensive nature, all the latest advances in the electrical industry being displayed. The display of electrical devices and appliances for the household was a predominating feature of the exhibits. All the latest types of electric irons, heating devices, culinary devices, washing machines, vacuum cleaners, massage machines, electric ranges, and water heaters were shown.

The latest advances in electric lighting were also typified by the comprehensive display of the incandescent and arc lamp manufacturers and the fixture and reflector manufacturers.

The various industrial power exhibits also received a large share of attention from the thousands of visitors. Every conceivable application of the electric motor to industrial operation was shown and the many working models on exhibition did much towards familiarizing the public with the numberless advantages and conveniences of this form of power.

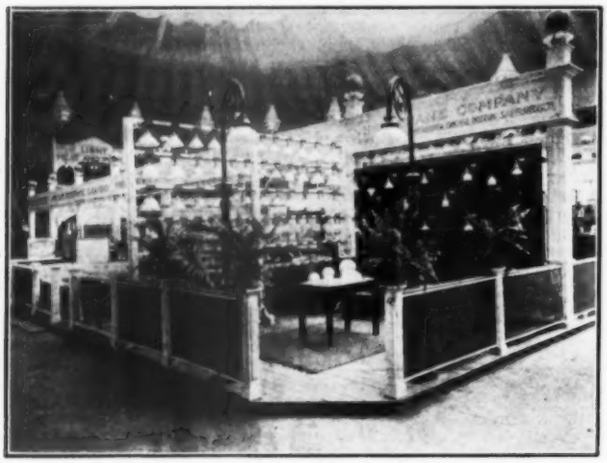
The exhibit of electric vehicles for both pleasure and commercial service was said to be the largest in the history of the electric vehicle. Electrics to meet every possible demand were shown and various features of construction and operation demonstrated. In this connection opportunity was offered the storage battery manufacturer to display the latest advances in the manufacture of storage batteries.

The telephone world was well represented by the numerous exhibits of the telephone manufacturers. The advantages of intercommunicating telephones for industrial establishments and telephones for train dispatching were well illustrated. Demonstrations of wireless telegraph and telephone apparatus was also made.

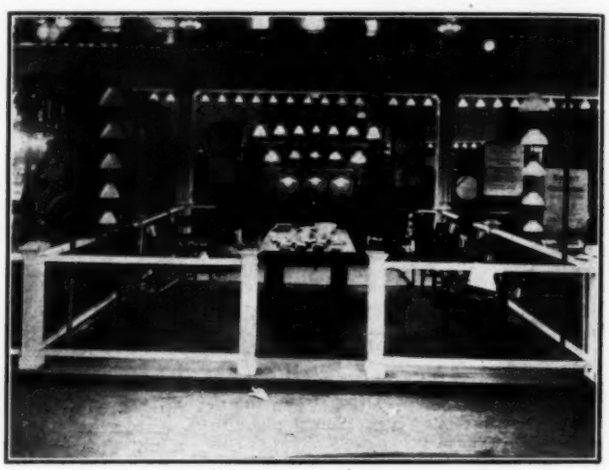
Other exhibits contained displays of various electrical fittings, wires, cables, electric signs, and specialties all of which form an important link in the perfection of things electrical.

The afternoon and evening sessions of the show during the ten days of its run were replete with interesting features. At one end of the great hall was the exhibition of Professor Ovington, who conducted several very interesting experiments with high-frequency electric currents. An entertaining musical program was carried out by d'Aquin's Military Band.

On Friday evening, October 14, the New York Edison Company entertained the electrical contractors at an "Edison Smoker." A buffet lunch was served, following which a very entertaining programme was carried out. Professional talent from the local thea-



THE HOLOPHANE COMPANY.



THE OPALUX COMPANY.

THE CUTLER-HAMMER MANUFACTURING COMPANY.

THE WESTINGHOUSE COMPANIES.

ters was secured and a very enjoyable evening spent.

Following this affair and at the close of the evening show the exposition was reopened for the benefit of the guests of the Edison Company.

Much credit is due the management of the show for the successful manner in which the affair was conducted. No effort or expense was spared in producing an exposition that will long be remembered as exemplifying the high standard of the electrical industry. Credit is also due M. A. Singer, who designed and constructed the decorations and booths. Mr. Singer was responsible for the attractive appearance of the auditorium at the electric show of last year and his work at the show of 1910 was a fitting successor to that well remembered spectacle.

In the accompanying illustrations are shown views of a few of the exhibits.

PELOUZE ELECTRIC HEATING COMPANY.

THE NATIONAL ELECTRIC LAMP ASSOCIATION.

THE HURLEY MACHINE COMPANY.

THE GENERAL ELECTRIC COMPANY.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

OCTOBER MEETING AT NEW YORK.

The two hundred and fifty-second meeting of the American Institute of Electrical Engineers, being the first meeting of the season, was held at the Engineering Societies Building, New York City, on the evening of October 14. This being the first meeting at which the new president, Prof. D. C. Jackson, presided, he made a brief address, calling attention to the several primary functions of the Institute. These seem to him to be threefold. The presentation and recording of papers denoting the state of the science and art of electrical engineering and improvements in that science and art is one of these functions; with this is associated the preservation of historical and biographical records. Another function is the guardianship of the professional status of electrical engineers. The third is the control of finances needful to make the first two functions effective. The present meeting was in pursuance of the first-named of these functions. Such meetings, however, are only a small part of the total activities of the Institute, and there is far more to attract the interests of members than the mere coming to the meeting.

A paper on "The Potential Stresses in Dielectrics," written by Dr. Harold S. Osborne and Prof. Harold Pender, was then presented by the former.

POTENTIAL STRESSES IN DIELECTRICS.

This paper is in two parts, the first dealing with the grading of cables and the second considering the development of corona in solid dielectrics. When a conductor is insulated by surrounding it with a homogeneous dielectric, the stress is greatest at the surface of the conductor and less on the outside layers of insulation. Two methods may be used to equalize this stress, viz., (1) by connecting to points of suitable potential layers of metal foil that separate

the layers of insulation, and (2) by increasing the capacity of the inner layers. The first method may be used in transformers and the second in the condenser type of transformer terminals by increasing the length of the inner layers of insulation. A method of increasing the capacity of the inner layers which does not require the insertion of metallic laminae is by grading the specific capacity of the dielectric so that it is higher in the inner layers than in the outer ones. This method is particularly suited to the manufacture of extra-high-tension underground cables. The grading of such cables results either in a material saving in volume of insulation required for a particular voltage and size of conductor or an increase in the voltage strength of the cable. A graded cable may be made with two layers of rubber, or an inner layer of rubber with an outer layer of impregnated paper, or three layers of rubber, or two layers of rubber with a layer of paper. The authors developed formulas which give the best theoretical design of a graded single-conductor cable of certain types for any given conditions. The effect of conductivity of the dielectric was found to be entirely negligible for ordinary materials and ordinary frequencies in alternating-current power transmission. An approximate solution is also given for multi-conductor cables. The second part of the paper is an investigation of the hypothesis advanced by Professor Russell that there exists in solid dielectrics a corona similar to that in air and which disrupts the entire overstressed portion uniformly, charring it and rendering it useless as insulation. Some experiments were made with cylindrical condensers which tended to disprove the idea of corona in solid dielectrics but showed that when such a dielectric is overstressed it has a number of points of disrupted material, just as if it had been pricked with many needle points. Commercial dielectrics cannot be perfectly homogeneous and do not break down uniformly when overstressed, but only at the weakest points. This explanation accounts for the various phenomena observed in these and earlier experiments without upsetting the assumption with regard to the electric strength of a dielectric, which is the basis of all analytical work on the subject. Although these analytical results are probably based on proper assumptions, when they deal with cases of partial breakdown account must be taken of the true character of that breakdown.

The discussion of the paper was one of the most spirited that has been heard before the Institute for a long time. Nearly a score of representative high-voltage men discharged mental sparks, as President Jackson called them, seven being communicated in writing.

Dr. J. B. Whitehead's discussion was the first presented. He called attention to the conspicuous absence in the paper of any attempts to harmonize the views presented with the ionization theory. Then he showed that all the phenomena found in the overstressing, partial breakdown or complete breakdown of solid dielectrics can be fully explained in terms of the ionization theory. Even the weakening of the insulation from overstress could be readily explained, because impurities in the material enable charges of overstrained adjacent molecules of the dielectric to be neutralized, thus leaving an unbalanced molecule or weak spot; this action naturally proceeds in the method described by the authors as needle-points.

Milton Franklin communicated a statement that he had prepared a mathematical paper analyzing the physical dimensions of cylindrical dielectrics. He is of the opinion that dielectric stress corresponds to a mechanical stress and that failure is due to the periodic application of this stress in alternating-current working and the ultimate fatigue of the material. As regards multi-conductor cables he disagreed with the authors about the distribution of charge.

Dr. A. E. Kennelly stated that the subject is of growing importance because of the rapidly increasing voltages used in underground cables. The curves presented permit the ready determination of grading of cables, but it should be noticed that there is a great difference between theoretically possible gradings and practically possible ones. Imperfect contact between different layers of insulation presents grave dangers akin to poor joints in a magnetic circuit. Pockets of air bubbles or layers serve as weak points in the insulation. The speaker cited a case where a wire was covered first with pure Para rubber and then with a thicker layer of vulcanized rubber; after applying an overstress there was found an increase of electrostatic capacity in almost every instance.

Prof. W. S. Franklin called attention to the laborious mathematical work involved in the preparation of the paper and which is not evident to the casual reader. He contended that the units of the electrostatic system should not be used in any engineering publication. The needlepoint hypothesis he holds to be largely true in gases as well as in solid dielectrics. It is also in entire accord with the ionic theory. It is not so marked a phenomenon as in the case of a crack in glass. Careful examination of the electric rupture in a piece of glass shows it to be periodic. The fact that the charging current which goes into the insulation showed no increase with overstress may be due to its being in quadrature with the main charging current. A simple physical picture of what takes place in a graded cable is desirable; probably the analogy of mechanical stresses in parallel is the best. A graded cable is not unlike a built-up cannon which has layers of highly yielding steel next to its bore and less and less yielding steel toward the outside.

W. I. Middleton asserted that while considerable is to be gained by the grading of cables for very high voltage, on the contrary for voltages below about 15,000 little can be gained because the wall of insulation would become too thin for the necessary mechanical strength. In making graded cables it would be better to use a combination of materials such as rubber, cambric and paper, instead of several layers of the same material. In extensive experience in the test room of a cable factory he had never noticed anything akin to charring of insulation on an overstressed cable. The formula formerly used in determining insulation thickness was reliable to the point where the copper diameter and insulating wall were equal, but beyond it was absurd. Therefore a modified formula has been used for these cases which is satisfactory.

Henry Morse verified Mr. Middleton's remarks on the value of the modified formula for small-sized wires. Before either formula had been developed guesswork alone was depended on.

R. W. Atkinson submitted that at the needlepoints suggested by the authors the conduction current is greater and the net result is a greater capacity than they calculate. This would not be noticeable on ordinary cables, however. Destruction of the insulation by corona cannot be due to heat, otherwise it would have been noticed.

H. W. Fisher contributed a brief discussion of the experimental results. He had never noticed any charring of insulation in overstressed cables. Breakdowns in such cables seemed to be due to gradual puncturing of the insulation about the conductor at the weakest point. Glass that has been overstressed by local discharges is usually found to be cracked; this verifies the authors' conclusions about isolated discharge along the conductor. A paper-insulated conductor in a hard-rubber tube would not have shown the results found with the glass tube. Recent German investigations do not indicate any increase in dielectric loss up to the point of puncture, such as one

would expect if a large number of discharges first occurred near the wire. Further experiments are necessary.

Percy Thomas spoke of the possibility of heat being a vital factor in the breakdown of insulation, particularly near the puncture voltage. He stated that fifty thicknesses of paper will withstand only about five times the voltage that one will. In glass the cracks resulting from overstress are likely due to local heating.

C. J. Fechheimer in a contributed discussion called attention to the use of graded insulation in the stator of high-voltage generators. The coils usually have a rectangular cross-section, and when insulated first with flexible mica and then with varnished cloth have a much higher breakdown point than with the latter insulation alone. This grading of insulation permits a more compact construction, promotes better transfer of heat, and puts the best heat resistor next the conductor. Placing tinfoil between the layers has a detrimental effect. The ideal grading would seem to be to have the potential stress in each dielectric proportional to its breakdown voltage. Mr. Fechheimer thought that it would give a clearer physical conception of the phenomena to consider the breakdown to be due to the dielectric stress per unit area reaching a critical value than to regard the potential per unit thickness reaching the critical point.

A. H. Pikler considered the subject in connection with the insulation of high-voltage power transformers. The perfection in this line in the last six or eight years he thought was brought about principally by keeping the moisture out of the oil. It is not possible to grade the insulation between coils and between them and the core because the utmost simplicity is required, whereas the introduction of metallic sheets between the layers would cause too much complication; moreover the need for compact insulation is not great as a certain amount of space is needed for cooling. The uniform distribution of the dielectric flux is more important than grading of transformer insulation. The ideal transformer as far as this point is concerned would have two concentric cylindrical coils. Pancake coils are very difficult to insulate for high voltage and the amount of insulation required is excessively high.

Dr. C. P. Steinmetz said he fully agreed with Dr. Franklin that electrostatic phenomena should be explained in so simple a manner that one can get as clear a physical conception of the phenomena as is now possible of magnetic phenomena by means of lines of force. As to the grading of cables, the results given in the paper are very suggestive, but it would be a mistake to use them as given in designing cables because the conditions are very much more complex than appears to be the case. High-voltage cables never break down from their operating voltage but they fail from transient excess voltages, from lack of homogeneous insulation and at weak spots. The mechanical character of the insulating material and the ability to obtain it without weak spots are of prime importance since they limit the variety of materials that can be used. If the transient excess voltage is of sufficiently short duration its energy may not be great enough to overcome the dielectric energy resisting breakdown, although if applied for sometime it would greatly exceed it. The needlepoint hypothesis of the authors Dr. Steinmetz considers to be an established fact. When the voltage is localized to bear on the dielectric it produces an electrostatic shearing strain and brings about breakdown at a much lower voltage than with a uniform field. Corona in air are probably similar phenomena to the needlepoint effects in solid dielectrics. An extensive investigation of the phenomena of electrostatic fields is now under way, some of the early results of which have partly upset Dr. Steinmetz's earlier views. He now doubts whether the breakdown occurs as soon as the potential gradient exceeds the dielectric strength at any point. The flow of current at the breakdown point affects the conditions in a marked degree.

C. O. Mailloux recalled some experiments on insulating materials made by him at Vienna thirteen years ago. In many instances actual breakdown was preceded by a pitting that he attributed to heating effect of the leakage current, hysteresis, or similar cause. Cables were guaranteed to much higher direct-current than alternating-current voltages probably because this heating effect is absent in the former.

Dr. Osborne then briefly closed the discussion by expressing his gratification at the manner in which his needlepoint theory had been received.

Electrical Appliances in Germany.

Consul-General Robert P. Skinner, of Hamburg, reports that while there is always a market in Germany for electrical devices not already supplied by domestic manufacturers, or which possess the elements of novelty and practical utility, the condition of the electrical industries in that country is such that German manufacturers are not only able to satisfy nearly all domestic requirements but are also exporting in immense quantities.

For a very considerable period, and until within the last few months, when, under the commercial agreement made possible by the present tariff law, American manufacturers obtained the benefit of the lowest rates of duty in Germany, electrical supplies from the United States were subject to import duties which ranged from one mark to fifty-six marks per 100 kilograms ($0.238 to $13.328 per 220 pounds) in excess of the duties applied to similar goods from other countries. For example, a large class of electrical devices for illumination, transmission of power, and counting and registering were dutiable at the rate of sixty marks per 100 kilograms ($14.28 per 220 pounds), if imported from the United States, or from four marks to forty marks ($0.952 to $9.52), according to weight, if imported from other countries.

Owing to this and other causes, German concerns, by arrangement, are manufacturing many articles of American invention, so that within the last few months, when the telephone system of Hamburg was entirely reconstructed, with the exception of a limited number of articles imported from the United States, everything was supplied by German houses, although the system, as a whole, is entirely American in conception. In this Hamburg plant, the operation of which began July 10, there are 112,700 relays that open and close the electrical current for the calling lamps, 1,000,000 meters of cable consisting of 35,000,000 meters of wire, two storage batteries having a capacity of 78,000 ampere-hours and 240 long-distance connections.

It is not impossible that the recent reduction of the rates of duty applicable to American electrical appliances will increase American trade in Germany under this head.

WINDING COEFFICIENTS FOR SINGLE-PHASE MOTORS.—II.

BY H. WEICHSEL.

The question of determining the magnetizing current necessary to counterbalance the impressed electromotive force is another one of considerable importance, and the equations already derived enable us to obtain a very simple solution for this problem. From the equations

$$N = K \frac{i Z}{R}$$

$$E = 2.22 \times 10^{-8} f Z N V$$

by substituting the value of N we obtain

$$i = \frac{10^8 E R}{2.22 f K Z^2 V}$$

$$R = \frac{a}{S}$$

where a = length of single air gap in centimeters;
S = effective pole surface in square centimeters.

$$i = \frac{10^8 E a}{2.22 f K Z^2 V S}$$

Expressed in the inch system this equation becomes

$$i = \frac{10^8 E a}{5.64 f K Z^2 V S}$$

$$= \frac{10^8 E a}{C Z^2 V S} \qquad (12)$$

$$= \frac{10^8 E a D}{Z^2 V S} \qquad (13)$$

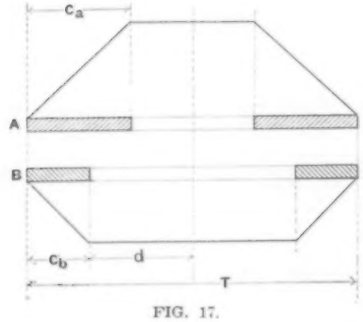


FIG. 17.

$$C = \frac{1}{D} = 5.64 f K$$

The values of both these coefficients for different winding distributions are given in the form of curves in Fig. 18. The values of K and f are to be found in Fig. 9. As an example of the method of calculating the coefficient D take a winding that covers fifty per cent of the pole pitch.

$$K = 0.666 \qquad f = 0.885$$

$$D = \frac{1}{5.64 \times 0.885 \times 0.666} = 0.3$$

The values of C are the reciprocals of the values of D. With the aid of either of these curves the magnetizing current can be calculated for the case that there are impressed E volts per pole per phase, and that there is only one winding which produces the field and the counter electromotive force. This is true so long as the iron reluctance is negligible.

In some cases, however, we have to deal with two windings which are connected in series, and which either assist or counteract each other in their magnetizing effect. This has been indicated in Fig. 17. The coefficient for a combination like this can be calculated as follows.

A current flowing through coil "A" produces the lines

$$N_a = K_a \frac{I Z_a}{R}$$

which produces in coil "A" the electromotive force

$$E_a = 10^{-8} C_a \frac{I Z_a^2 V S}{a}$$

as shown above. The lines N_a, produced by the winding "A" induce also an electromotive force in winding "B" which is equal to

$$E_{ab} = 2.22 \times 10^{-8} N_a Z_b V f_{ab}$$

where f_{ab} is the coefficient given by the curves of Fig. 10, referring to a field distribution as produced by winding "A" and a winding distribution as shown for coil "B." In the same way we find the electromotive force induced by the field "B" in coil "B" to be equal to

$$E_b = 10^{-8} C_b \frac{I Z_b^2 V S}{a}$$

and the electromotive force generated in coil "A" by field "B" is

$$E_{ba} = 2.22 \times 10^{-8} N_b Z_a V f_{ba}$$

All these electromotive forces are connected in series, so the resultant electromotive force is

$$E = E_a \pm E_b \pm E_{ab} \pm E_{ba}$$

$$= 10^{-8} \frac{SIV}{a} (C_a Z_a^2 \pm C_b Z_b^2)$$

$$\pm 2.22 \times 10^{-8} V (f_{ab} N_a Z_b + f_{ba} N_b Z_a)$$

But since

$$N = \frac{KIZ}{R}$$

$$R = \frac{a}{2.54 S}$$

$$E = 10^{-8} \frac{IVS}{a} \Big[C_a Z_a^2 \pm C_b Z_b^2 \pm 5.64 Z_a Z_b (K_a f_{ab} + K_b f_{ba}) \Big]$$

Let

$$C_{ab} = 5.64 (K_a f_{ab} + K_b f_{ba}) \qquad (14)$$

Substituting this and transposing the equation

$$I = \frac{10^8 Ea}{SV (C_a Z_a^2 \pm C_b Z_b \pm C_{ab} Z_a Z_b)} \qquad (15)$$

The values of C_a and C_b are given in Fig. 18 as previously explained. The values of C_{ab} have been calculated from equation (14) and plotted in Fig. 19. The use of these curves might be still further explained by an example. Assume that the two coils "A" and "B" are connected in series and magnetize in the same direction. Coil "A" has eighty conductors per phase belt and spans 50 per cent of the pole pitch. Coil "B" has thirty conductors per phase belt and spans 80 per cent of the pole pitch. These coils are acting on an air gap of one thirty-second inch, and the effective air-gap section per pole is sixteen square inches. The voltage impressed per pole is fifty volts at sixty cycles.

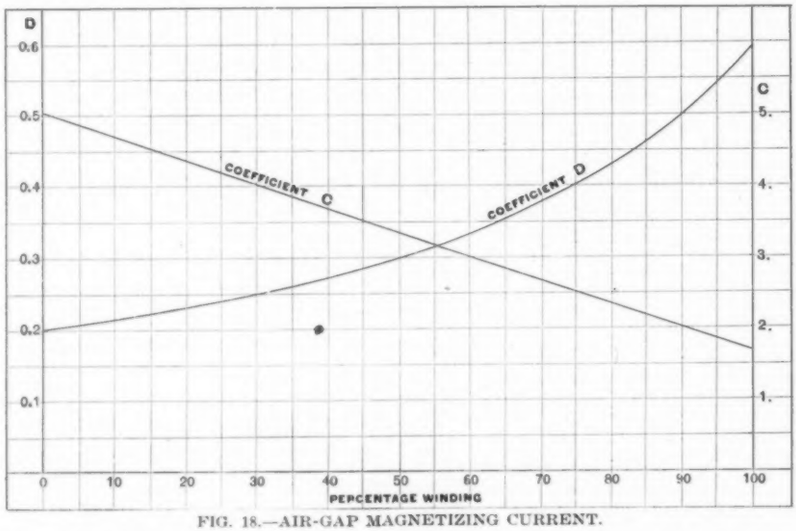


FIG. 18.—AIR-GAP MAGNETIZING CURRENT.

The following, then, are the values to be substituted in equation (15) to obtain the air-gap magnetizing current.

$E = 50$
$Z_a = 80$ (fifty-per-cent wound)
$Z_b = 30$ (eighty-per-cent wound)
$a = 0.3125$
$S = 16$
$V = 60$
$C_a = 3.33$ (See Fig. 17)
$C_b = 2.33$
$C_{ab} = 5.5$ (See Fig. 19)

$$I = \frac{50\times0.03125\times10^8}{16\times60(3.33\times80^2+2.33\times30^2+5.55\times80\times30)} = 4.45$$

If, however, the windings oppose each other we have

$$I = \frac{50\times0.03125\times10^8}{16\times60(3.33\times80^2-2.33\times30^2-5.55\times80\times30)} = 27.0$$

From this example it will be seen that the expression

$$C_a Z_a^2 - C_b Z_b^2 - C_{ab} Z_a Z_b$$

must always be positive in value. If in our example we had called the "A" winding "B" and the "B" winding "A" we should have obtained a negative quantity for the expression in parenthesis, but we should have to introduce the value as a positive one in the equation for magnetizing current.

The question of determining the number of magnetic lines of a field such as we have been considering is a simple enough problem after having determined the equation for the magnetizing current. We have seen before that the current I produces in field "A" the lines

$$N_a = K_a \frac{I\ Z_a}{R}$$

Since the two coils are in series the same current flows in coil "B" and produces

$$N_b = K_b \frac{I\ Z_b}{R}$$

lines. The total number of lines produced by the two windings is the sum or difference of N_a and N_b, depending on whether they magnetize in the same direction or oppose each other.

$$N = N_a \pm N_b = \frac{I}{R}(K_a Z_a \pm K_b Z_b)$$

$$I = \frac{N R}{(K_a Z_a \pm K_b Z_b)}$$

$$R = \frac{a}{2.54\ S}$$

Substituting these in equation (15) we get

$$N = \frac{2.54\times10^8\ E\ (K_a Z_a \pm K_b Z_b)}{V(C_a Z_a^2 \pm C_b Z_b^2 \pm C_{ab} Z_a Z_b)} \quad (16)$$

The values of K_a and K_b are to be found in Fig. 9. C_a and C_b are to be found in Fig. 18, and C_{ab} is given in Fig. 19. It will be understood that in these equations where the double sign is used, the plus sign is to be taken when the windings magnetize in the same direction, and the negative sign when the windings oppose.

We have derived the relation between the primary and secondary electromotive forces, if the windings are concentric but have not the same winding distributions. In the following we will derive the ratio of current transformation for the same case. Fig. 20 represents the vector diagram for an ideal transformer without resistance drop or leakage. The magnetizing current I_0 produces sufficient field to counterbalance the impressed electromotive force, E. The secondary current i_2 produces a field in phase with and proportional to i_2. This necessitates a current i_1 opposing i_2 and producing a field N_1 proportional to i_1. The magnitude of this field is determined by the fact that the field N_2 produces an electromotive force in the primary winding which must be equal and opposite the electromotive force induced in the same winding (primary), by N_1. We have, therefore, this relation.

$$N_2 Z_1 V f_{21} = N_1 Z_1 V f_1 \quad (17)$$

$$N_1 = \frac{i_1 Z_1 K_1}{R}$$

$$N_2 = \frac{i_2 Z_2 K_2}{R}$$

$$i_2 Z_2 K_2 f_{21} = i_1 Z_1 K_1 f_1 \quad (18)$$

$$i_2 = i_1 \frac{Z_1 K_1 f_1}{Z_2 K_2 f_{21}} = i_1 \frac{Z_1}{Z_2} G \quad (19)$$

In this equation f_{21} is the electromotive-force coefficient for the primary winding and secondary field shape as given in Fig. 10. f_1 is the electromotive-force coefficient for the primary winding and its own field shape. (See Fig. 9.) K_1 and K_2 are coefficients for number of lines for primary and secondary respectively, as shown in Fig. 9. The coefficient G has been calculated for a series of primary winding distributions and different secondary winding distributions and plotted in Fig. 22.

Referring to equation (18) we have seen that balanced conditions exist when

$$i_2 Z_2 K_2 f_{21} = i_1 Z_1 K_1 f_1$$

Under these conditions all voltages disappear in the primary winding except the voltage due to the magnetizing current I_0. But it is still an open question whether all electromotive forces in the secondary disappear with the exception of that due to I_0. The field produced by i_2 induces an electromotive force in the secondary winding proportional to

$$E_2'' \propto i_2 Z_2^2 K_2 f_2$$

and the current i_1 in the primary winding produces a field proportional to $i_1\ Z_1\ K_1$ which acts on the secondary winding and generates the electromotive force

$$E_2' \propto i_1 Z_1 K_1 f_{12} Z_2$$

Substituting

$$i_1 Z_1 K_1 = \frac{i_2 Z_2 K_2 f_{21}}{f_1}$$

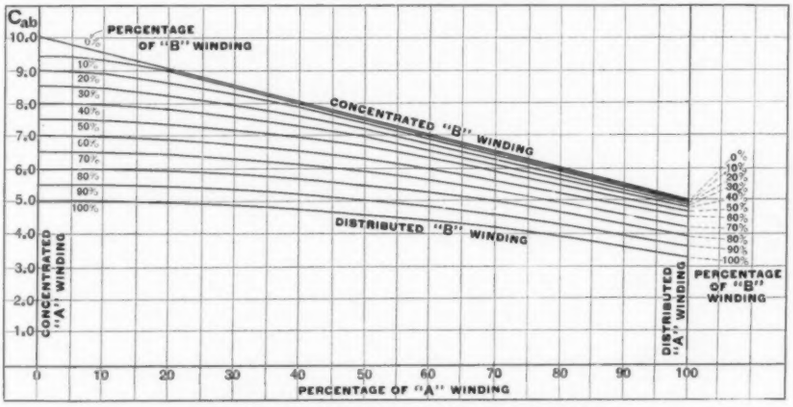


FIG. 19.—AIR-GAP MAGNETIZING CURRENT.
(Two coils in series.)

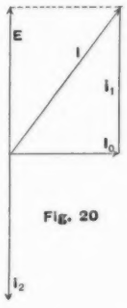


Fig. 20

Fig. 21

from equation (18) we get

$$E_2' \propto \frac{i_2 Z_2^2 K_2 f_{21} f_{12}}{f_1}$$

due to primary current and

$$E_2'' \propto i_2 Z_2^2 K_2 f_2$$

due to secondary current.

$$E_2'' - E_2' \propto i_2 Z_2^2 K_2 \left(f_2 - \frac{f_{21} f_{12}}{f_1} \right)$$

These proportionalities become true equations if we multiply by the constant factor

$$2.22 \frac{V}{R} 10^{-8}$$

The exact equation reads therefore

$$E_2'' - E_2' = 2.22 \frac{V}{R} 10^{-8} i_2 Z_2^2 H \qquad (20)$$

where the coefficient

$$H = K_2 \left(f_2 - \frac{f_{21} f_{12}}{f_1} \right) \qquad (21)$$

By substituting the proper values of K_2, f_2, f_1, f_{21} and f_{12} we find that the voltage

$$E_2'' - E_2'$$

does not become zero except for the case where the primary and secondary have the same winding distribution. This plainly shows that a transformer whose primary and secondary windings have not the same winding distribution acts like a transformer with a certain amount of leakage. We may therefore call the voltage

$$E_2'' - E_2'$$

the "apparent leakage-reactance voltage." It is also possible to find an expression for leakage coefficient in the same way as for a transformer with real leakage. The leakage coefficient in general is usually expressed as the ratio of leakage-reactance voltage to the voltage produced in the secondary winding by the secondary current if the primary winding did not exist.

$$q = \frac{E_2'' - E_2'}{E_0} = \frac{i_2 Z_2^2 K_2}{i_2 Z_2^2 K_2 f_2} \left(f_2 - \frac{f_{21} f_{12}}{f_1} \right) = 1 - \frac{f_{21} f_{12}}{f_1 f_2} \qquad (22)$$

This is called the "apparent leakage coefficient," and values of it have been calculated for different winding distributions and plotted in Fig. 23. The coefficient H, the leakage-reactance-voltage coefficient, has also been calculated and plotted in Fig. 24, but instead of using equation (21) it has been calculated from the equation

$$H = q K_2 f_2 \qquad (23)$$

which is readily derived from equation (21). An example will illustrate the use of these curves. Assume that the primary has a winding covering fifty per cent of the pole pitch, and the secondary has a winding covering ten per cent of the pole pitch. The apparent leakage-reactance coefficient will be found from the curve to be equal to 0.081. That means that any secondary current I_2 will produce a leakage reactance voltage equal to

$$e = 0.081 \times 2.22 \times 10^{-8} I_2 Z_2^2 \frac{V}{R}$$

In order to make a very general use of the coefficients derived in this paper it will be necessary to study, somewhat, the different windings used on single-phase rotors. The simplest of all these is the well-known Gramme ring. The field produced by currents flowing in a Gramme ring has a triangular shape, and this is equivalent to a winding whose phase belt is 100-per cent wound. All coefficients derived on previous pages can therefore be applied to a Gramme-ring winding if the value of the coefficient for 100-per cent winding distribution is selected. It will be readily seen that the same is true for any drum winding if the coils are wound in such a way that they span exactly one pole pitch. Fig. 21 represents a section through such a drum winding.

Frequently, however, it will be necessary to use a fractional-pitch wound rotor. A diagrammatical view of such a winding is given in Fig. 25. This diagram has been drawn up for a two-pole armature with twenty-eight teeth. Each armature coil spans ten teeth. The individual coil spans therefore ten-fourteenths, or 71.5 per cent, of the pole pitch. The two brushes are represented by B_1 and B_2 exactly one pole pitch apart. The study of this armature with chord winding will be greatly facilitated by assuming for a moment that a direct current is sent into the armature by means of the brushes B_1 and B_2. The arrows shown on the diagram represent the direction of currents in each individual conductor. It will be seen at a glance that on certain

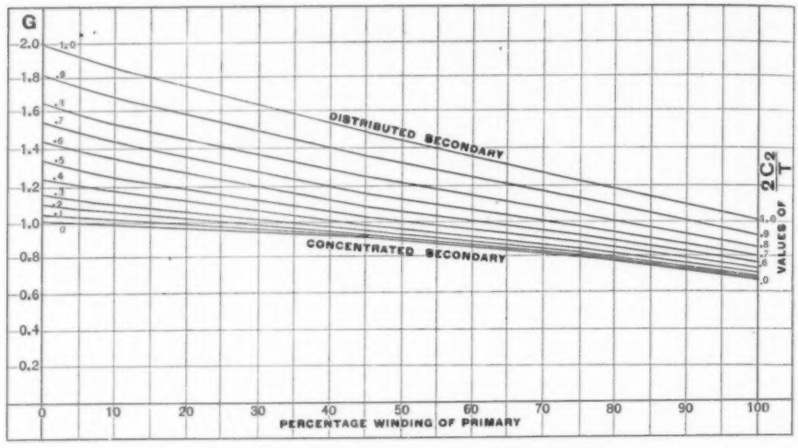


FIG. 22.—TRANSFORMER CURRENT COEFFICIENT.

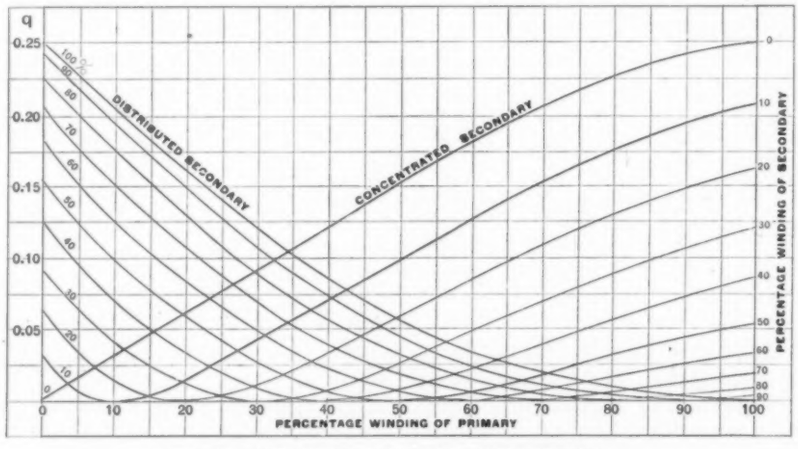


FIG. 23.—APPARENT LEAKAGE COEFFICIENT.

parts of the armature the currents in two adjacent conductors oppose each other, thereby cancelling the magnetic effect of these conductors. The field produced by the winding has therefore a distribution as shown in the lower part of Fig. 25. A further consideration of this figure will show that an armature with coils spanning 71.5 per cent of the pole pitch has the same field distribution as that produced by an armature with concentric winding covering 71.5 per cent of the pole pitch. This brings us to the very important fact that a chord winding with individual coils spanning A per cent of the pole pitch produces the same field distribution as a concentric winding with the phase belt covering A per cent of the pole pitch. It will be readily seen that all conductors within the section a-b and c-d do not contribute any voltage to the terminals if the winding be subjected to a transformer action. The voltage across brushes due to transformer action is therefore identical with the voltage which would be induced in a concentrated winding which is A-per-cent wound, and which has AZ conductors per phase belt, if Z represents the total conductors per pole on the armature. All the equations and curves derived on previous pages can therefore be applied to rotors with chord winding if we use as the number of conductors the value AZ, and as value of percentage winding, the ratio $A = t/T$, where t equals the number of teeth spanned by armature coil; and T equals the number of teeth per pole.

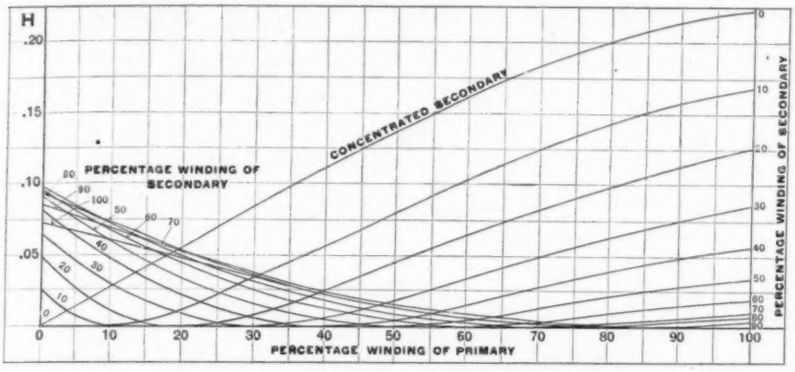


FIG. 24.—LEAKAGE REACTANCE COEFFICIENT.

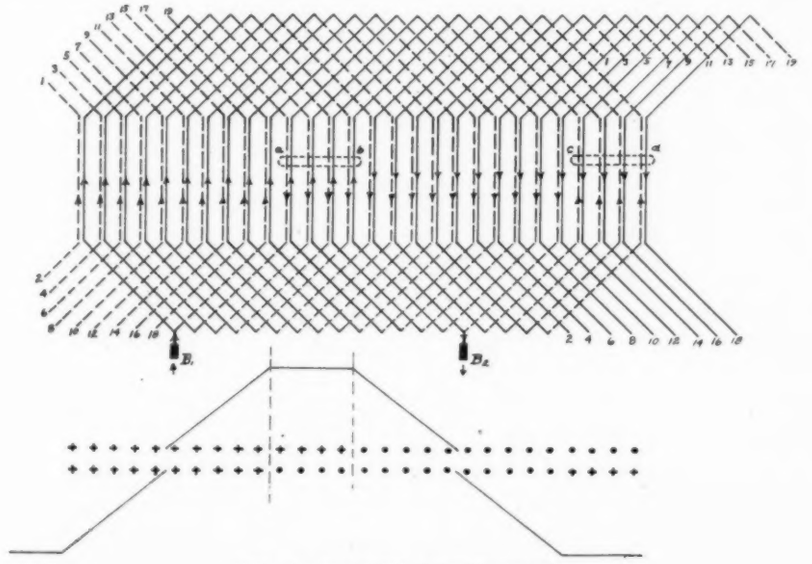


FIG. 25.—WINDING DISTRIBUTION.

In the rotor of single-phase motors we have to consider electromotive forces of induction, conduction and rotation. We have seen that all phenomena due to induction and conduction can be determined by using the formulas and curves derived on previous pages. The electromotive force due to rotation will be derived in the following.

If a conductor cuts lines of force with a velocity of v centimeters per second an electromotive force equal to

$$E = 10^{-8} B l v$$

will be set up in the conductor if its length is l centimeters and the magnetic field has B lines per square centimeter. Assuming that the rotor has Z conductors per pole, or

$$\frac{PZ}{2\pi r} ds$$

conductors per element of circumference; and that the velocity is

$$v = \frac{2\pi r n}{60},$$

the electromotive force generated in

$$\frac{PZ}{2\pi r} ds$$

conductors will be

$$dE = 10^{-8} B l \frac{2\pi r n}{60} \frac{PZ}{2\pi r} ds$$

$$= 10^{-8} B l \frac{n}{60} P Z ds$$

and the total electromotive force per pole equals

$$E = 10^{-8} \frac{n}{60} P Z \int_{s_1}^{s_2} B l ds \qquad (24)$$

It is evident that for a full-pitch armature winding the limits of integration of equation (24) are $s_1 = 0$ and $s_2 = T$, the pole pitch. For this case we get the voltage per pole

$$E = 10^{-8} \frac{n}{60} P Z N \qquad (25)$$

For armatures with chord winding, however, only those lines are active which cut the conductors on the part b-c and d-a; or, what means the same, the lines which are embraced by a coil located symmetrically to the center of the pole. In general, then, we can express the electromotive force per pole as

$$E = 10^{-8} \frac{n}{60} P Z N M \qquad (26)$$

where M represents the ratio of the lines embraced by one armature coil to the total lines per pole. The voltage E is the voltage across Z conductors. If the rotor has a parallel winding the voltage E equals the voltage between brushes. If, however, the rotor has a two-circuit winding it will be necessary to multiply E by $P/2$ in order to obtain the voltage between brushes, where P represents the number of poles. In the above derivation we assumed that N, the number of magnetic lines, is independent of time. If, however, N is a function of time, let us say

$$N = N_m \sin pt$$

it is evident that the voltage will also vary according to the law

$$e = e_m \sin pt$$

The effective electromotive force generated in Z conductors by rotation in a magnetic field, the lines of which vary with the time according to the sine law, is therefore given by

$$E = \frac{10}{60\sqrt{2}} n Z P N_m M$$
$$= 1.18 \times 10^{-8} n Z P N_m M \qquad (27)$$

(To be continued.)

Electric Shock.

At the seventy-eighth annual convention of the British Medical Association, held recently in London, among the numerous valuable papers presented was one by Dr. S. Jellinek, of Vienna, Austria, who read an interesting paper on the "Disorders and Death Following Electrical Shock." Dr. Jellinek is one of the greatest authorities on the effects and treatment of electric shock and electric burns and has written several books and papers on these subjects. As reported in *The Lancet*, the following were the chief points of this paper, which was illustrated with numerous drawings, diagrams and lantern slides.

The most important question seems to be: Which current is dangerous? Simple as is the question, the answer is difficult—a statement which receives confirmation when it is remembered that, while in some cases fatal accidents have been brought about by 100 volts, in other cases in which the voltage has been 1,000, and even 10,000, recovery has ensued. In order to understand a matter so seemingly inconsistent it should be kept in mind that the danger of an electric current depends on circumstances which might be placed in the following two categories: (1) The external—(a) voltage; (b) amperage; (c) number of poles, or points of application; (d) the time of contact; and (e) the kind of current (direct or alternating). The direct current appears to be more dangerous than the alternating. 2. The individual—(a) the resistance of skin and body; (b) the way, or the path, of the current through the body and over the surface of the skin; and (c) the conditon of mind and body.

With regard to section (a) of the second category, the resistance of the skin plays a very important part, and not only the resistance of entrance, but also that of exit for the current. In most instances of accident, in connection with the resistance of exit, i.e., the feet, the earth is the determining factor as to whether contact is dangerous or not. A contact might be made with 100 volts and more if there were good insulation as regards the feet; but it must be borne in mind that good contact with earth might sometimes be made even in well insulated rooms—for instance, carpeted rooms—if in so close proximity to water pipes or gas pipes as to touch them with any part of the body. As to section (b) Dr. Jellinek said that the failure of American electrocution is most probably due to causes connected with the management of the poles, which are much moistened, a great part of the current passing over the surface of the skin, and thus not coming in contact with the organs of sensibility—the brain, the heart, etc. Under section (c) there is, he said, an enormous difference between the touching of a current intentionally (the mind being prepared and ready for the shock) and doing it accidentally; in the latter case the shock is liable to produce an inhibition of the functions of important organs.

Electricity which passes into the body has, he said, two actions—a psychological action and a material action to the cells of the brain through microscopical vessels of the brain, the spinal cord, the heart, etc. The result of both those actions might be either disease or death. The clinical symptoms emanate from various organs—unconsciousness, spasm, paralysis, hemorrhage of the kidneys, degeneration of nerves, etc. The alteration of the skin sometimes takes the form of genuine burnings and sometimes of so-called specific electric changes, which are quite different in character from other wounds. It is important to know that genuine electric lesions are painless.

With regard to the mechanism of death by electricity there is no definite scheme or model. In most cases it seems like suspended animation. It is an interesting fact that there is between electric shock and death an interim of a few seconds in which the stricken person appears to be in quite a normal state. By experiments on dogs in the physiological institute of Professor von Tschermak it had been discovered that the irritability of the brain, which had subsided immediately after a shock, had a few seconds later become re-established, and everything then depended upon whether the action of the heart would be continued or not. As there are sometimes hemorrhages of the brain, and as the pressure of the cerebro-spinal liquid is increased, it is necessary and important in cases of first-aid to lay the patient with head elevated.

It would, Dr. Jellinek thought, be well to educate children—and, indeed, the people generally—by means of pictorial illustrations demonstrating how accidents by electricity originate, and how to avoid them. In Austria the government has ordered such instruction in certain schools and good results have already followed, the number of accidents in the city of Vienna being one-third less now than a few years ago, despite the increasing use of electrical energy. Dr. Jellinek also described a number of interesting experiments made with a view to clearing up some of the many apparently confusing symptoms found in the numerous cases he had investigated.

Japanese May Build Elevated Road.

With a view of securing more satisfactory rapid transit in Tokio, Japan, the Municipal Council of that city has passed a resolution advocating the construction of an elevated railroad. Considerable opposition is, however, being offered by the merchants of the main street, along which this road would run, as they consider that their business would be materially injured.

The projected elevated line is thirty-one miles in length and will involve a cost of about $13,500,000. It will be built upon a series of brick arches that will carry the track level at a height of twenty-two feet. Several subway projects presented during the past two years have been rejected by the government board of railways, as too fantastic to merit consideration.

Receivers for Chicago and Southern Traction Company.

Joseph E. Otis and Matthew Slash have been appointed receivers for the Chicago and Southern Traction Company, which operates a suburban line in the southern extremity of Chicago, and an interurban line connecting this with Kankakee, Ill. The receivership was ordered on application of bondholders, the reason being that the road defaulted on the interest of $2,500,000 bonds.

DENVER ELECTRIC SHOW.

SUCCESSFUL EXPOSITION HELD UNDER THE AUSPICES OF THE COLORADO ELECTRIC CLUB.

When all of the steam whistles in Denver, Col., and vicinity sounded their shrillest blasts, and Denver was ablaze with red fire and boomed into joyful excitement by exploding bombs Saturday night, October 8, the men who have seen all of the big electrical shows, and who saw the flashing on of the thousands of lights in the Auditorium, exclaimed at almost the same instant: "Greatest electric show ever given in this country." These same men, who are not interested in Denver beyond any other city, repeated their opinions after a complete inspection of the great display that entertained tens of thousands during the week from Saturday to Saturday. The opening was the most spectacular affair ever witnessed in Denver, and probably the most impressive ever created by an electric show, or any other show.

While the great auditorium, literally ablaze with lights, and resounding to the various noises created by electrical appliances in action, was packed and jammed with more than ten thousand men, women and children, a crowd estimated by the most conservative at a hundred thousand passed and repassed upon the streets surrounding the big building in which the show was held.

Seemingly at least one-half the population of Denver had taken to the business district to see the illuminations and give the show a fitting opening night. With those from nearby towns, the crowd was so dense that all police plans were upset, and the merrymakers took possession of an area for many blocks about the show.

Every newspaper and every public official in Denver agreed that the crowd was the greatest in the history of the city. The people were attracted to the center of lights about the big show, with the lamp-studded auditorium as the center, the festoons of incandescents on the streets in the immediate vicinity as the extending lights of welcome to those headed for the show.

The street illuminations were unique and complete, and the great crowd seemed well pleased; so well pleased, in fact, that for every night of the show many thousands came down to have another look, bringing with them other thousands who did not have the opportunity to be "among those present" on the opening night.

With such a flying start, with all of the resultant mouth-to-mouth publicity that is the most difficult to achieve, the first annual electric show of the Colorado Electric Club, could not fail to mark a success. With only a limited population to draw upon, the reports show that all of the surrounding states were well represented in the attendance, and that every town and city in Colorado had its quota of interested spectators.

While no one man claims credit for the inception and success of the show, the honor is given by common consent

FORMAL OPENING OF DENVER ELECTRIC SHOW—SWITCHING ON THE LIGHTS.

to Frank W. Frueauff, vice-president and general manager of the Denver Gas & Electric Company, and a member of the firm of Henry L. Doherty & Company of New York, controlling numerous properties.

The organization of the Colorado Electric Club was the first step toward bringing about the first annual show, and providing an organization for future shows. Having set the ball rolling and satisfied with those associated, Mr. Frueauff gave unstinted aid as vice-president of the club, which has a strong corps of officers throughout.

With this organization, aided by committees led by the various directors, the show was launched six months ago. The result has been a representation from practically all of the big manufacturers, a generous showing from local business concerns, and an interest on the part of the public greater than in any similar event ever held in Denver.

For show purposes the Auditorium in Denver is almost built to order. The building covers a large half-square and there is not a pillar in it. Like all of the public buildings in Denver, the great structure is studded with incandescent lamps, and the interior lighting has been arranged with unusual care.

The entire lower floor of the great structure was divided into booths, and all of the floor space was taken by exhibitors. This left the two galleries for spectators.

Entering the great show-room the spectators' eyes were met with every manner of electric light, in every color and arranged for every imaginable purpose. At the same time the various sounds created by electricity assailed his ears, and in an instant he was supplied with an abundance of the sensation craved by the American public—action. There was "something doing every minute" in every booth of the electric show.

To describe individual displays at length is impossible, because each could be given many hundreds of words without exhausting the subject. In the four-score and more exhibits the visitor was shown every conceivable practical use for electricity, from the most powerful hoist to the most delicate lamp.

As a means for providing the visitors with entertainment beyond that supplied by the show itself the Electric Club brought Innes' band of forty-five men from the East. Two concerts were given daily, afternoon and evening, although the show itself was open from ten o'clock in the morning on.

The basement of the big building was turned over to W. P. Carstarphen. Mr. Carstarphen called his portion of the show the Chamber of Wonders, and at hourly intervals entertained and astonished large crowds of wondering men and women who were his guests.

The Chamber of Wonders was a large room draped in black. It was equipped with specially designed apparatus for producing enormously high voltage at high frequencies. This apparatus consisted of on oil-immersed transformer with a primary winding taking 440 volts, sixty-cycles, alternating current, the secondary giving 150,000 volts, this

current being connected to the primary of a Tesla coil through the medium of large forty-plate glass condensers, and multiple spark gap oscillator, which produce at the secondary terminals of the Tesla upwards of one million volts, at an enormously high frequency.

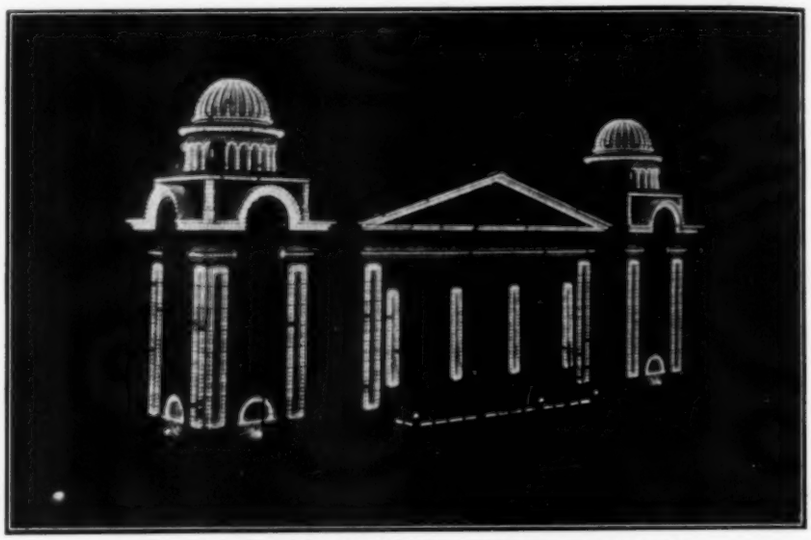
The effects of high voltage and high frequency were exhibited by various pieces of apparatus, showing the disruptive power, through the piercing of glass plates, brush discharge, climbing arc, illuminating of Geissler tubes and vacuum electrodes, imitation thunder and lightning, passing of the million volts through the body of the experimenter, and lighting incandescent lamps held in hs hand, without wire connections, and many other beautiful and spectacular demonstrations.

Other features of the Chamber of Wonders were the electric water forge, in which bars of iron were heated red-hot by immersing in cold water; the telautograph, transmitting writing and drawing over wires; the singing arc; the Thompson electro-magnetic experiments, including the lighting of incandescent globes immersed in water without wire connections, leaping rings and discs; wireless telegraph and telephone and many other modern applications of electricity. This display excited perhaps the greatest wonder of all sections in the show.

Perhaps the most striking feature in the main auditorium was the display made by the Electric Club itself, which reproduced a painting showing a waterfall with the moon slowly sinking from sight. Automatically, as the moon faded, the picture was brightened, and gradually and magnificently, the sun came up slowly from behind the hills. All of the time the water ran down the little brook and dropped over the falls in a most realistic manner. The entire effect was produced by electricity. This display occupied nearly one side of the upper portion of the auditorium, and was the first thing to be seen by each person on entering the show.

To add interest and give as many features as possible to the show, the Electric Club dedicated each day to some especial function. As W. H. Green, the oldest of Colorado's pioneers, was selected to turn the switch that set the show in motion, so the opening day was dedicated to the pioneers. The other "days" were: Monday, Society Day; Tuesday, Jovian Day, when the Sons of Jove held forth; Wednesday, Columbus Day; Thursday, Woman's Club Day; Friday, College Day, and Saturday, Children's Day.

The following is a brief description of each exhibit:



NIGHT VIEW OF ENTRANCE TO DENVER AUDITORIUM.

Allis-Chalmers Company, Milwaukee, Wis., displayed electrically-driven air compressors and a line of motors from one to fifty horsepower. H. L. Woolfenden, district manager represented the company and was assisted by J. O'Ryan, F. B. Fanger and Miss Zoe Rawlings of the Denver office.

American District Telegraph Company, Denver, Colo., represented by W. E. Root of Denver, showed models of watchman and messenger service apparatus and fire-protection devices.

American Multograph Sales Company, of Cleveland, Ohio, exhibited an electrically-operated multograph and folding machine in operation. A. L. Chandler, of Denver, represented the company.

American Steel and Wire Company, of Colorado, exhibited electric wires, cables, rail bonds for electric street railway use, wire rope and bare and insulated copper wire. Represented by G. L. Anderson.

Arnold Electric Vibrator Company, Racine, Wis., displayed electric vibrators. Mrs. M. Johnson, western representative.

Barker Cuisinette Company, Denver, exhibited library tables with kitchen equipment combined. Used for three purposes, dining table, kitchen cabinet and library table.

G. J. Booth, Denver, demonstrated Eureka vacuum cleaners and vibrators.

Burroughs Adding Machine Company, Detroit, Mich., displayed electrically-driven adding machines in operation. C. G. Cotton, Denver, Colo., was in attendance.

GENERAL VIEW OF EXHIBITS—SPECTACULAR PICTURE IN BACKGROUND.

Cahn-Forster Electric Company, Denver, Colo., exhibited electric therapeutic lamps, electric vibrators and coils, and various electrical appliances. Represented by Mrs. A. Cahn, Denver, Colo., and Mrs. S. K. Bossie.

Capital Electric Company, Denver, Colo., displayed a full line of Hall Mazda, tantalum, Gem and standard carbon lamps. Construction of stem for filament lamps was shown.

Represented by A. R. Hall, Denver, Colo., and Theo. Mueller, of the Kansas City office.

Carstarphen Electric Company, Denver, Colo., exhibited X-Ray and high-frequency displays for medical purposes, panel and switchboards, storage batteries and spark coils. In the basement the experiments of the Colorado State School of Mines were exhibited under the supervision of Professor W. J. Hazard. A. F. Russell, of Denver, represented the Carstarphen Electric Company.

THE DENVER SHOW ON OPENING NIGHT.

Central Colorado Power Company, Denver, Colo., exhibited tower tops of transmission lines and maps and photographs of districts supplied with electric current. C. E. Rudy, J. E. Dalton and D. F. Miner were in attendance.

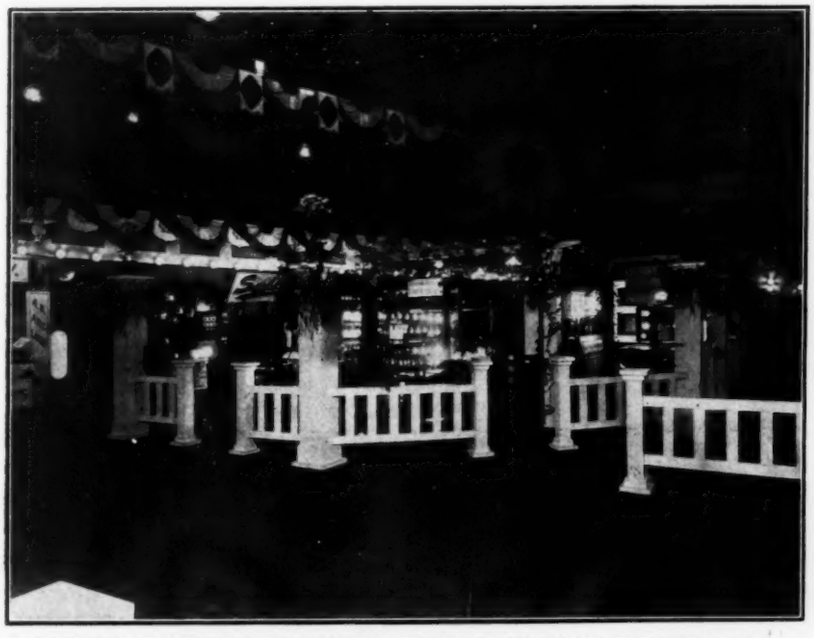
Central Electric Company, Colorado Springs, Colo., represented by Jas F. Boynton, with a display of electrical appliances and devices.

Clayson Map Company maintained an exhibit of electric blue-printing machine in operation. Represented by Chas. L. Gillette.

Colorado Machinery & Supply Company, Denver, showed a line of electrical pumps, vertical air compressors and direct-current exhaust fans. J. E. Barker and R. M. Farrar represented the company.

Colorado Telephone Company, Denver, exhibited ancient and modern switchboards. Represented by W. J. Brown.

Columbia Phonograph Company, New York City, exhibited the dictograph. Bruce Henry, district manager, was in attendance.



PORTION OF AUDITORIUM SHOWING BOOTH OF NATIONAL ELECTRIC LAMP ASSOCIATION.

Cook Railway Signal Company, Denver, Colo., exhibited miniature railway block-signal systems and crossing signals. W. J. Cook, Denver, inventor, represented the company.

Crocker-Wheeler Company, Ampere, N. J., displayed National X-Ray indirect lighting reflectors and lighting systems, Pelouze electric irons and appliances and Ozone pure arifiers. D. Vance Sickman, western manager, representative.

Denver City Tramway Company displayed equipment used since 1889, also lightning arresters, modern automatic switch systems and the General Electric Company's electrolytic lightning arrester. Wm. G. Mathews, superintendent of overhead lines, was the representative.

Denver Dry Goods Company made a display of artistic stand lamps and chandeliers. D. L. Crossley, Denver, was in attendance.

Denver Electrical Company exhibited chandeliers, electric-heating devices, novelties, and wiring devices. C. Rider and R. H. Edwards were the representatives.

Denver Electric Wiring Company, showed a line of electrical appliances and heating devices. C. B. Thorn, president, represented the company.

Denver Gas & Electric Company displayed a model electric home showing all equipment used. The appliances for this exhibit were furnished by the Simplex Electric Heating Company of Chicago, Ill. In the basement of the Auditorium an exhibit of the various electric laundry and cooking appliances was made. C. N. Stannard had charge of the exhibit.

Denver Omnibus and Cab Company exhibited Exide storage batteries and ignition batteries for gasoline vehicles. Represented by J. R. Strugnell.

Denver Rock Drill Company showed Dean vertical single-acting triplex pumps, Foos engines and mine hoists, Curtis air compressors, Clayton and McCully electric rock crushers, and a working model of a Ward rock drill. C. L. Newcomb was in attendance.

Electric Fireless Cook Stove Company, Buchannon, Mich., exhibited electric fireless cook stoves, and a combination kitchen cabinet and electric cook stove. Sebring Phelps represented the company.

Electric Storage Battery Company, Philadelphia, Pa., displayed "Chloride" and Exide Accumulators" and small lighting outfits for farm or suburban use. Represented by D. Luther, Denver.

Electrical Supply & Construction Company, Denver, exhibited new Imperial washing machines. Represented by E. E. Stafford, Independence, Kansas. The company also showed vacuum claaners and electrical appliances, W. J. Keating, representative for Electrical Supply and Construction Company, Denver.

Ellis Sign Company exhibited electric signs and letters, Jas B. Ellis, Denver, representative.

Flint & Lomax, Denver, displayed an electric welder in operation, also electric automatic screw machine and power hammer. J. J. Flint, representing the firm and G. G. Keplinger operating electric welder; A. Leason operating screw machine.

General Acoustic Company, New York City, displayed the Acoustican for the deaf, the Dictograph and Dimaphone was also shown. Represented by P. E. Chamberlin and Miss A. Bryant.

General Electric Company, Schenectady, N. Y., made a complete display of single and three-phase motors for industrial uses, low-voltage sign lamps and Mazda lamps, also a line of electrical heating appliances and devices, electric unit gas engine and electric ranges. W. W. Torrence was in attendance.

General Vehicle Company, Long Island City, N. Y., made a display of electric trucks for commercial use. Represented by P. C. Chrysler, western manager.

Hadley & Hine, Denver, exhibited Elliott and Fisher electric billing and adding machines, Barrett adding and calculating machines, Flexotype electric duplicating machines. Jess W. Hadley and J. H. Hine, representatives.

Hendrie & Bolthoff Manufacturing and Supply Company, Denver, displayed operating electric pumps for irrigation use, exhaust fans, blowers, generators, motors and circuit-breakers. Also electric mining machinery and tungsten lamps. J. C. Davidson represented the company.

Jackson & Wood, Denver, made a complete display of improved electrical headlights for automobiles. O. E. Wood and R. Jackson, representatives.

Krebs-Covington Auto Company, Denver, displayed Detroit electric pleasure cars equipped with Edison storage batteries. Represented by A. S. Krebs and W. R. Covington.

Lindrooth-Shubart Company, Denver, showed Goodman electric locomotives, Kerr steam turbines, Turbo generators, and Ridgway automatic engines and generators. B. Shubart, representative.

Mine and Smelter Supply Company, New York City, exhibited patent friction electric drill, mine hoists, electric irrigation plant in operation. This Company also made the first display of electric triplex hoist and magnetic face plates in Colorado. All exhibitions were shown operating. Represented by R. S. Rubican of the Denver office, and D. A. Wright, of New York City.

Mountain Electric Company, displayed motors, electrical appliances, irons and vacuum cleaners. Represented by J. J. Cooper, Denver.

National Carbon Company, Cleveland, Ohio, exhibited a line of arc-lamp carbons, brushes and batteries. Represented by F. J. Kysela.

The National Electric Lamp Association occupied four booths, displaying the complete 100-125 volt line of "Mazda" multiple lamps, including pear-shaped, meridian and round bulbs symmetrically displayed on a "burning" rack. On the same rack was a string of "Mazda" street-series lamps of all sizes, up to and including 250 watts, and a display of tantalum 200-250 volt lamps, all lighted. Another "burning" rack shows "Mazda" multiple lamps equipped with Holophane reflectors of the new "Stiletto" prism type. This rack is bordered with twenty "Mazda" full frosted five-watt sign lamps. On a third rack, miniature and low-voltage lamps were shown. A couple of photometric devices, one consisting of a rotatable set of mirrors, for measuring light at different angles around a lamp, and the other consisting essentially of a Bunsen spot-box, a 100-watt carbon filament lamp and a 100-watt "Mazda" lamp were displayed and operated in order to demonstrate the principles underlying the commercial measurement of light. The Engineering Department representatives of the Association at the show were L. S. Twomey and C. P. Soderburg.

New England Electric Company, Denver, exhibited Sterling lamps, Klein tools and a new adjustable lamp hanger. Represented by F. A. Pattison, Denver.

Northern Colorado Power Company, Denver, displayed maps of locations supplied with current. Co-operating with Hendrie & Bolthoff's display on mining and irrigation.

Northwestern Supply Company exhibited Tripartite steel poles for transmission lines and the Pittsburg Insulator Company's insulators. Represented by H. J. Barker and G. S. Smith.

Ogier, Silsbee & Ogier, Denver, showed process for treating poles and cross arms with creosote. Represented by J. A. Silsbee, Denver.

Onderdonk Engineering Company, Denver, representatives for Babcock & Wilcox boilers, asbestos goods and Logando boiler specialties. Chas. S. Onderdonk, Jr., Denver, representative, was in charge.

Robinson & Bull, representing Vohr Ozone Company, Chicago, Ill., actual demonstrations of the Vohr ozone maker, W. C. Bull, Denver, in charge of exhibit.

Robinson & Rogers Supply Company, Denver, exhibited Hughes electric ranges, Sykes electric fireless cookers and other electrical devices and appliances. Represented by F. E. Robinson and A. C. Jahl, Denver.

The Sangomo Electric Company, Springfield, Ill., exhibited a full line of ampere hour meters for electric vehicles. The company was represented by S. E. Sanderson.

Chas. A. Schrien Belt Company, Denver, displayed belting material for electrical machinery. Represented by Herman A. Giese, manager.

Sechrist Manufacturing Company, Denver, displayed artistic portable lamps, chandeliers, gas and electric fixtures and art glass used in the manufacture of these goods. Bert Wasien was in attendance.

Silver State Electric Company, Denver, demonstrated armature winding on an alternating-current, two-phase Westinghouse motor. The Company also showed electric automobile horns and electrical fixtures. R. M. Willoughby representative.

Simplex Electric Heating Company, Chicago, Ill., displayed a full line of electrical heating appliances. Represented by Henry F. Holland, Chicago.

Sterns-Rogers Manufacturing Company, Denver, displayed Heine safety boilers, Avery scales, Door classifiers and blowers, Harris air pumps, operating Ingersoll Rand compressors and Ingersoll-Temple drills. A. B. Kennedy and R. W. Gordon, representatives.

Studebaker-Colorado Vehicle Company exhibited Studebaker 2,500 pound electric trucks. H. E. Barnwell, electrical engineering department, Denver, representative.

Wagner Electric Company, represtend by Electric Manufacturing Sales Company, Denver, made a complete display of Wagner motors and transformers and electrical instruments. O. H. Davidson was in charge.

Western Vacuum Cleaner Sales Company, Denver, exhibited Keller-Santo vacuum cleaners. Represented by W. E. Peters, Denver.

Western Electric Company, made a novel display of its representative houses all over the world. H. W. Hall, district manager, and M. H. Nichols, representatives.

Western Engineering Specialty Company, Denver, made a display of vacuum cleaners, electric washing machines, electrical appliances and the Dostal drop-outs. Represented by W. A. Cowling.

Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., exhibited a line of motors for power, buffing and utility purposes and demonstrated the endurance of wire-type tungsten lamps. Represented by L. M. Cargo.

Western Electric Sign Company, Colorado Springs, Colo., exhibited electric signs and letters. Represented by R. P. McConnell, Colorado Springs.

Electrical Companies Compared.

The financial conditions of the large electrical firms in this country and abroad were interestingly compared in a recent issue of the Wall Street Journal. This account shows among other things that the companies abroad not only show larger net earnings on capital invested, but make larger returns to their stockholders than American industrials. An excellent example is found in comparing the earnings and dividend payments of the two largest electrical companies abroad, the Allegemeine Electricitats Gesellschaft and the Siemens-Halske Gesellschaft, with the corresponding figures, as last reported by the General Electric and the Western Electric companies, which are shown in the accompanying table.

	West Elec. Nov. 30, '09	Gen'l. Elec. Dec. 31, '09	Allegemeine June 30, '09	Siemens Halske July 31, '09
	Dec. 1, '08	Feb. 1, '09	July 1, '09	Aug. 1, '08
Capital stock	$15,000,000	$65,179,600	$23,800,000	$15,000,000
Bonds	110,348	14,962,000	12,210,000	6,320,000
Surplus	17,436,786	17,381,382	11,977,000	3,770,000
Net investment	34,574,958	97,522,982	53,800,000	30,700,000
Net profits	2,090,264	6,493,671	3,900,000	2,730,000
Dividends	8%	8%	13%	12%
Net earnings on net investment	6%	6.7%	7.2%	8.9%

The American electric companies have apparently followed the policy of building up large surpluses while on the Continent large dividend distributions are the rule. From which it appears that American electric companies not only are run on a smaller margin of profit, but are more conservatively managed than the electric companies abroad.

Pittsburg Section Meeting.

The Pittsburg Section of the American Institute of Electrical Engineers held a meeting on October 11, at which there was a discussion of the paper by Stott and Pigott on "15,000-Kilowatt Steam-Engine-Turbine Plant," read at New York. H. C. Fairbanks summarized the paper and brought out the improvement in economy of this station by adding a low-pressure turbine to a condensing engine. It is generally thought that the place for a low-pressure turbine is in a non-condensing plant.

E. D. Dreyfus and W. B. Flanders called attention to the comparatively low efficiency of a turbine in per cent of Rankine-cycle efficiency when compared to a high-pressure reciprocating unit. There is a probability of improvement in this regard. R. F. Patterson told of the remarkable cheapness of power from low-pressure turbines at the power plant of the Pressed Steel Car Company.

W. L. Waters and F. W. Harris discussed the electrical features. The induction generator is especially adapted for use in this type of plant on account of the large charging current of underground cables, and the low short-circuit current of this type of generator.

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring.

ELEMENTS OF POWER-STATION DESIGN.—VIII.

PRELIMINARY ELECTRICAL REQUIREMENTS.

BY W. B. GUMP.

No feature of a power development requires deeper thought or keener judgment than that demanded in designing the electrical system. This portion of a power equipment is the connecting link between the generator and the consumer, and should be so arranged that changes and extensions due to the growth of the community may be accommodated without interruptions in service or inconvenience in operation. Hence the electrical side of a power system must be planned with a view well into the future if satisfactory results are to be realized.

It is at once evident that no fixed rules can be laid down with reference to the design of electrical systems, since the factors most vital to the electrical

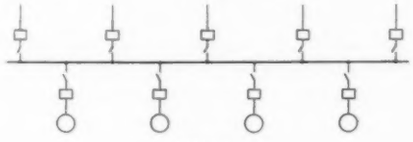


FIG. 1.

side of a plant are mainly local, and are of so great a variety that an attempt to treat them in detail would be little better than useless. This fact notwithstanding, there are certain general requirements which power-station practice may be said to have established. The most important of these requirements form the basis of the following discussion.

It is understood first of all that the nature of the power market has been thoroughly investigated, and the conditions to be satisfied carefully studied. If it be a field not previously exploited, the determination of a design best adapted to the power market is to a large extent speculative. If the system is laid out with due respect to flexibility, the operating requirements which follow can generally be accommodated.

General Layout.—In considering the electrical system for a proposed development it is usual first to sketch a number of general wiring schemes, discussing the various advantages and disadvantages of each, and finally to select the one which appears to suit the particular

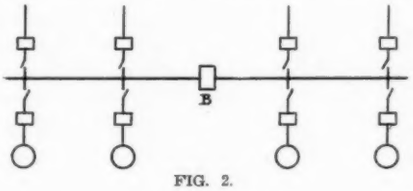


FIG. 2.

operating conditions in the best manner. In attempting to bring out the points of difference relating to wiring diagrams it becomes necessary to generalize, both as to classification of systems and as to the applications of each.

Consider first the simplest layout, that of Fig. 1, which embraces four generating units, each connected through one switch to a single low-tension bus. The desired number of feeders are connected to the bus through their respective feeder switches. Such a system is applicable more especially to steam-driven plants of not over 2,000 kilowatts in which the load is almost entirely lighting. Its flexibility is limited on account of being tied together as one unit. The bus is alive at all times that the plant is in operation; hence, extensions, alterations or cleaning of the bus cannot be carried on while the plant is running except it be done under full potential. In isolated plants or manufacturing plants which do not operate continuously, this arrangement is not particularly objectionable, especially with low voltage. In a large system, however, where the plant operates continuously and the generator potential is above 1,000 volts, this scheme is generally unsatisfactory, particularly with a mixed load.

Suppose that the plant in question has to accommodate both railway power and lighting. It then becomes advantageous to segregate the power from the lighting, so as to eliminate any possibility of interference of either one with the other.

Under such circumstances two arrangements are available: (*a*) A sectional bus; (*b*) two separate busses.

The first scheme is shown in Fig. 2, in which *B* is a bus switch or "tie" switch, used to connect or separate the two sections of the bus. It is obvious that one section may accommodate the lighting and the other the power. These sections, however, are not transferable, and this is a drawback to such a scheme. Furthermore, suppose that a breakdown occurs on No. 1 generator, unless there is a reserve unit for this portion of the load an interruption to the system is inevitable, if the sections remain isolated. The alternative lies in closing the bus switch and connecting the load with the other section. This, of course, is feasible during an emergency, but the object sought in sectionalizing is partially de-

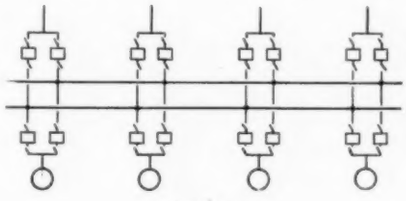


FIG. 3.

feated. It is, therefore, clear that in order to prevent interruptions considerable reserve capacity is needed, depending mainly on the load-factor, and on the ratio of average power load to lighting load.

Increased flexibility is to be had in a two-bus system, as shown in Fig. 3. The additional cost, however, is an item of great importance, and it is often apt to be an excessively large proportion of the total cost of the plant. Here the number of switches is doubled, the capacity remaining the same as in a single-bus system having the same operating conditions. In a large system the generator voltage would be from 6,600 to 12,000 or 13,500 volts. This demands an expensive bus structure which with the

extra cost of switches and copper greatly increases the original investment, requiring additional floor space and hence a more costly building. In stations of great capacity which supply large amounts of power demanding absolute continuity of service, a two-bus scheme is usually regarded as a profitable investment. This applies to plants such as those at Niagara Falls, the generating stations of the Interborough Rapid Transit Company, of New York City, and many similar stations in which the distribution of power is local. The manner of operation has a direct bearing upon the bus arrangement required, and many large plants are operating satisfactorily with a single low-tension bus.

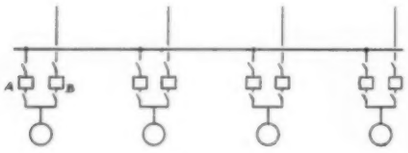


FIG. 4.

A single low-tension bus system which is quite flexible in its operation is shown in Fig. 4. This scheme permits any of the generators to energize a feeder directly, without being connected to the busbars. This is accomplished by opening switch *A* and closing switch *B*. Such a plan is applied more especially to high-tension systems, such as Fig. 5, in which *L* is the low-tension bus and *H* the high-tension bus. In the particular arrangement shown each bank of transformers and the transmission line to which it is connected become a unit with the generator. In the case of large hydroelectric plants having a number of substations such an arrangement is in many instances desirable, as it isolates trouble on any transmission line or bank of transformers. Here six oil switches are shown for each unit, including oil switches on each side of the transformers. Under the conditions of operation usually met in a large system of this kind it is not advisable to dispose of any of the switches shown. It would be possible, however, to substitute air-break switches in place of No. 3 and No. 4, and under certain circumstances this might be feasible.

Capacity and Number of Units.—As a general rule a power station should have at least four units. Five are to be preferred in many plants. More than five units are not desirable except in very large stations, as the cost per kilowatt of generators, switching apparatus, and the cost of operation increase with the number of units. Where there are a large number of substations, from six to ten units may be advisable, the number being determined by the number of transmission lines needed, the load-factor, and the method of operation, as well as certain peculiar local conditions.

It is evident that the capacity per unit should be as large as the ultimate development will permit; that is, the normal capacity will be:

Kilowatts per unit=

$$\frac{\text{ultimate output in kilowatts}}{\text{least ultimate units permissible.}}$$

In other words the denominator of the fraction ranges between 4 and 10, as previously stated, depending upon the size of the system and other important factors. If it is found that a great many years will doubtless elapse before the ultimate capacity is reached, the first installation may be satisfied with two units, preferably with three in most cases, however, even if the capacity per unit is reduced accordingly, since three units give considerably more flexibility than two. An even number of units, such as four or six, is an advantage in systems in which it becomes advisable to cut the load into two equal parts. With complete interchangability, however, an odd unit may be held in reserve to advantage.

Choice of Potential.—Until a few years ago the terms "low tension" and

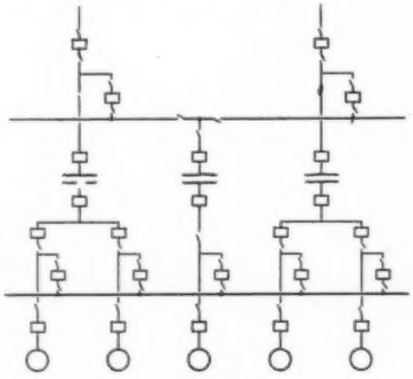


FIG. 6.

"high tension" were more closely drawn than at the present time. Formerly a line potential above 1,000 volts was generally regarded as "high tension". Today a large number of plants are operating with a potential of from 11,000 to 22,000 volts at the generator terminals. Where such plants use step-up transformers the generator side is termed "low tension." On the other hand a transmission line carrying 12,000 volts is often termed "high tension" as distinguished from the generated voltage in connection with it. The terms are, therefore, relative.

With respect to the voltages commonly employed it is to be noted that generator potential increases with the capacity, practice having established potentials about as given in the table.

Rated capacity of generator.	Potential at general terminals.
750 kilowatts and above...	2,300 volts
2,000 kilowatts and above...	6,600 volts
5,000 kilowatts and above...	11,000 to 22,000 volts

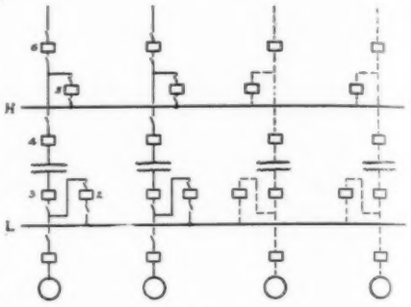


FIG. 5.

This table must not be followed closely, as it has many exceptions, and is at best only approximate. The object of high voltage is evidently to save copper both in the generator and in the distributing system. With small generators it is clear that, as the potential is increased, the cost of insulation reaches a prohibitive value.

The potential to be adopted on the high tension side is governed by the transmission voltage. As this is a matter involving a number of factors which are more or less complex it is discussed separately in the chapter devoted to transmission.

Arrangement and Choice of Transformers.—It is desirable in certain power systems to connect more than one generator to a transformer bank. In a few instances one bank of transformers becomes a unit with three generators. Fig. 6 shows a scheme involving five units, the two outside pairs of which are each connected to a bank of transformers respectively. In an emergency the middle bank may be switched to either outgoing line, and is perfectly interchangeable with any generator or pair of generators as a unit.

Relative to a choice between single-phase and three-phase transformers it should be stated that a number of factors are involved which must be considered carefully before making a decision. The comparison drawn here is understood to be between a group of

three single-phase transformers and one three-phase transformer of the same total output.

The advantages of the three-phase transformers are: (*a*) Lower cost; (*b*) less weight; (*c*) less floor space; (*d*) greater efficiency; (*e*) simplified wiring.

The reduction in cost of a three-phase against three single-phase transformers of the same total output is approximately fifteen per cent. Since the weight is reduced, the transportation charges are lower. Exceptions to this may occur where abnormal difficulties arise in conveying heavy apparatus over rough mountain roads. In such instances it may prove cheaper to cart several small transformers than one large one.

The advantages of item (*c*) and item (*d*) are evident. Item (*e*) is important from the fact that the wiring is more direct, as there are but half the number of the terminals brought out of the case. This generally affords more convenient grouping of the apparatus for a unit than with banks of single-phase transformers, and shortens the work of putting a reserve unit into service.

Some of the disadvantages of the three-phase transformers are: (*a*) Higher cost for a spare unit; (*b*) more difficult to repair; (*c*) more difficult to bring out leads for different voltages.

On account of item (*a*) alone, it can be concluded that small plants are almost invariably better equipped with single-phase transformers, since the proportionate cost of a three-phase transformer unit is considerably higher than in a large plant. All things considered, a large system should favor three-phase transformers when the investment and the operating conditions justifies them.

(To be continued.)

Electric Production of Steel in Russia.

The subject of the electrical manufacture of steel is engaging the attention of Russian iron and steel producers at the present time. In May of the current year the first electric furnace, which is of the Heroult type, and has a capacity of three and one-half tons, was set in operation at the Obuchoff steel works near St. Petersburg. Now two other Russian works have acquired licenses for the working of the Heroult-Lindenberg process from the Electro Steel Company, of Remscheid. A three-ton furnace is to be erected at each works for the production of special castings and high-grade steel.—*Electrical Review*, (London).

NEW SMOKE-CONSUMING FURNACE.

BY WILL L. LOWRIE.[1]

A Carlsbad architect, Alois Sichert, has invented a form of smoke-consuming furnace which has been patented all over the world and which has shown excellent results in practical use. The idea is a simple one, but so effective that the poorest quality of Bohemian coal, a soft lignite, may be used with a combustion of 84.7 per cent and practically no smoke or soot. This invention insures a draft of hot air driven down on the fire from above, beating back the smoke as it endeavors to rise and consuming it completely.

The coal is placed in a feeding box and slides therefrom over an inclined grate to a flat grate, until the whole surface of the two grates is uniformly covered. The inclined grate is provided at its upper half with narrow air apertures like a polygonal grate, and at its lower half with wider longitudinal apertures. The flat grate likewise has longitudinal apertures. The fire is started on the flat grate and forms an intense flame jet which extends over the inclined grate to the flues. During this operation the coal on the upper half of the inclined grate up to the feeding box gives off its gases and slides gradually downward onto the flat grate as the combustion on the latter proceeds, thereby continuously replacing the consumed coal. The necessary air is supplied to the grate through an air valve and this can be regulated in accordance with the degree of heat to be attained.

In the ashpit immediately beneath the flat grate are the inlet openings of the air-supply passages for consuming the smoke. Through these passages the air previously heated in the ashpit enters the ascending passages, passes into the arched passages, is heated therein and passes through apertures directly into the combustion chamber, and combining with the flame produces a perfectly smokeless combustion. By this procedure all particles of smoke, soot and sulphur from the coal are entirely consumed. The flame burns quite white and passes out through the flues as a smokeless flame into the chamber in which it is to be used for any special purpose.

[1]Consul, Carlsbad, Austria.

Moreover, in combination with each of the ascending flues, a further air-supply passage is provided for the direct supply of external air, so that in the case of coal containing a large amount of sulphur a sufficient quantity of air may be supplied through the ascending flues to the arched flues and through these to the combustion chamber, when with a low fire the valve is to a great extent closed. The passages can be controlled by dampers. If the grate surface is quite covered and an intense fire is required the valve must be fully opened. By this means, a large quantity of air enters the ashpit and passes through the air flues into the arched flues above the fire and through the apertures into the combustion chamber.

This process keeps step with the development of the fire in the combustion chamber. When a slower fire is desired, the valve is more nearly closed, the supply of air is less, and, therefore, the fire is lowered. With a slower fire less smoke is produced and less air is required to burn it.

The Sichert system is being used extensively in Carlsbad. It was first installed at the municipal slaughter house, and after twenty-seven months' constant use the chimney is unstained by soot or smoke. About sixty kitchens in the city have been equipped with the smoke consumers. This is an absolute necessity in the large public gardens, where thousands of people are served refreshments each day during the "cure" season. There are no volumes of smoke to harm the trees nor soot to soil the clothes of the patrons.

The boilers of the Elizabethbad, the newest municipal bath house, have been equipped with the Sichert apparatus. Here the poorest quality of Falkenau coal (a soft lignite) is used, and the chimney is smokeless. It would be impossible to use this grade of fuel without the consumer, as the bath is in a small park in the center of the city. As a matter of economy it may be mentioned that the city saved enough on its fuel bill at this bath in six months to pay for equipping the two boilers.

The system may be used on locomotives, and several American railroad men and coal-mine owners who have visited Carlsbad recently are enthusiastic over the possibilities of the top-draft system.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

Convention of Illuminating Engineering Society.

As previously announced, the fourth annual convention of the Illuminating Engineering Society will be held in Baltimore, Md., October 24 and 25. The sessions will be held in McCoy Hall, Johns Hopkins University, the morning sessions beginning at ten o'clock and the afternoon sessions at two-thirty. On Monday evening there will be a public lecture in McCoy Hall by V. R. Lansingh, followed by a reception in the Physical Laboratory and a view of the apparatus to be used in the lecture course. On Tuesday evening there will be a subscription banquet for both ladies and gentlemen at the Hotel Belvedere. Among the speakers at the banquet will be Mayor Mahool; Dr. Ira Remsen, president of the University; Dr. E. P. Hyde, the president of the Society; Hon. F. C. Latrobe; Gen. George H. Harries.

Other entertainment features are planned for the ladies.

In addition to the list of papers announced two weeks ago, there will be one by E. B. Rosa and E. C. Crittenden entitled "Report of Progress on Flame Standards."

On Tuesday afternoon the lecture course will be opened by appropriate exercises. As already announced, this course of thirty-six lectures on illuminating engineering has been arranged by Johns Hopkins University and the Illuminating Engineering Society conjointly and will extend from October 26 to November 8, inclusive. There will be three lectures each day, at 9:00 and 11:00 a. m. and 3:00 p. m., respectively. Many of the technical schools, central stations and manufacturers are sending men to attend this course of lectures, and a registration in excess of 100 is already assured.

The course of lectures, as announced in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for June 11, has been modified as follows: E. G. Cowdery, of the People's Gas Light and Coke Company, Chicago, will deliver one of the lectures on "Manufacture and Distribution of Gas." Prof. Robert M. Yerkes, of Howard University, will speak on "Psychological Aspects of Illuminating Engineering." Prof. W. E. Barrows, of Armour Institute, will contribute two lectures on "Principles and Design of Interior Illumination." The fee for the course, including laboratory instruction, is $25.

The officers of the Society have extended invitations to the following organizations to send representatives to the banquet: American Institute of Electrical Engineers; American Gas Institute; National Electric Light Association; American Institute of Architects; Ophthalmological Association; Academy of Ophthalmology; International Acetylene Association; National Commercial Gas Association; Association of Railway Electrical Engineers; American Academy of Oto-Laryngology.

Illuminating Engineering Society, New York Section.

The first regular monthly meeting of the 1910-11 season of the New York Section of the Illuminating Engineering Society was held on the evening of October 13 at the Engineering Societies Building. Street lighting was the matter under discussion and three papers on that subject were presented.

Chairman V. R. Lansingh called upon Preston S. Millar, who presented the first paper, entitled

UNRECOGNIZED ASPECT OF STREET ILLUMINATION.

Mr. Millar's paper calls attention to the effectiveness of street lighting in promoting discernment of objects and discusses the general subject of discernment. The chief purposes of street lighting are the detection of the presence of objects in the street and the detection of surface irregularities. Vehicles and pedestrians must be detected and their location observed. The character of holes in, and obstructions on, the surface should be disclosed ,but their presence must at least be detected. Surface irregularities are perceived because some portion is brighter or darker than the immediate surrounding surface and this depends on the intensity of the illumination at the spot. If not enough light falls on it, the irregularity will not be observed. Large objects, such as vehicles and pedestrians, are seen either by direct light incident upon them or, in street lighting perhaps more often, by being silhouetted against the background. If this background is fairly bright, the outline of the obscuring object usually discloses its character. As most objects to be discovered are dark, the background, i. e., street surfaces, should be bright. Within wide limits the brightness of a surface is independent of its distance from the observer.

Mr. Millar illustrated his paper by means of a model of a street lighted by miniature lamps.

The second paper, "A New Holophane Street Light Reflector," was read by H. S. Whiting. This proved to be a review of the work conducted by A. J. Sweet and reported by him before the Franklin Institute, Philadelphia, in a paper entitled "Illumination Requirements in Street Lighting." The reflector which was constructed to meet these requirements was described in detail, the principal feature of which being the absence of light from the horizontal to twenty-six degrees below.

A. J. Marshall followed with a short descriptive paper on

A RECENT STREET-LIGHTING INSTALLATION AT WASHINGTON.

Mr. Marshall's paper described the lighting of Sixteenth Street, Washington, D. C. This is a series tungsten installation, single lamps being mounted with the tip down in ground-glass globes fifteen inches in diameter on top of ornamental iron columns. The center of the lamp is 10.25 feet above the sidewalk. Two-and-one-half miles of the streets are lighted in this way. The lamps along the first mile are 100-watt twenty-volt series tungstens. Along the remaining portion, which is less traveled, fifty-watt lamps are used. The posts are spaced about sixty feet apart as measured in the axis of the street and are staggered.

The three papers were discussed together. The first speaker was Dr. C. H. Sharp, who complimented the engineers of the Holophane Company upon the results they accomplished, but who seemed to think that the twenty-six-degree angle was too small. Others entering into the rather desultory discussion were W. H. Gardner, Henry Floy, V. R. Lansingh and E. P. Hyde.

The next meeting of the Section will be held on Thursday evening, November 10.

Illuminating Engineering Society, Chicago Section.

The Chicago Section of the Illuminating Engineering Society held the first of this season's monthly meetings in the Chicago Room of the Great Northern Hotel on October 13. Directly after luncheon Chairman F. J. Pearson called the meeting to order. He stated that the recent campaign for increase of membership had the gratifying result of adding over 200 members to the Chicago Section. The society's annual convention and the special course of lectures on illuminating engineering at Johns Hopkins University were alluded to and Geo. C. Keech, 40 Dearborn Street, Chicago, was delegated to arrange so that those attending from Chicago could travel in a party on the same train. F. H. Bernhard was elected secretary of the Section for the ensuing year. Chairman Pearson announced that the following programme had been prepared for the successive monthly meetings of the Section:

November.—Résumé of the Society's convention and the Johns Hopkins lectures by those who attended. December.—Report of some original research work at the University of Illinois, by Professor Bryant. January.—Discussion of Dr. Ives' paper on "Luminous Efficiency," to be opened by A. L. Eustice. February.—Illumination problems in small cities. March.—Illuminating features in the new People's Gas Building, by C. A. Luther. April.—Recent developments in car lighting, by C. R. Gilman. May.—Tests on the illumination of a small room, by J. R. Cravath. June.—Natural daylight illumination.

Jos. Newman, Jr., of the International Harvester Company, then presented a paper entitled

GOOD LIGHTING FROM A FACTORY VIEWPOINT.

One of the aims of the modern factory system in Mr. Newman's opinion, is to maintain production at its maximum during the entire working day. There is, however, a tendency for the operatives to slacken their work as darkness approaches. One of the most potent reasons for this is the common inadequacy of the artificial lighting facilities. Factory managers have not realized that money spent to make the transition from daylight to artificial light as little apparent to the employees as possible will pay dividends. Lack of light has caused a large amount of waste of human energy and of material. As labor becomes more valuable the need of welfare work becomes greater. Well-lighted and ventilated shops promote the efficiency of the organization. Good lighting also greatly reduces the number of accidents to employees. Many things must be considered in laying out a truly commercial lighting system. The requirements are not the same in the different departments. In the foundry the lighting must be even but the intensity not great. Units of high candlepower placed above the travel of the crane give satisfaction. For molding small parts additional individual lamps are also needed. This is particularly true in malleable-iron foundries where higher intensity is required. Machine shops do not require quite as much general illumination, from 1.0 to 1.5 foot-candles on the working plane being sufficient. Where there are many columns, shafts and belts to obstruct the light, it is best to use relatively small lamps, 80 candlepower being a convenient unit. When much larger lamps are used a greater number of eight and sixteen-candlepower lamps will be required for localized lighting at lathes and other intricate tools. Large enameled intensive shades should be used and the units placed over the tools and work. Wood shops can be easily lighted by the judicious placing of intensive units over the machines. Paint shops as a rule need no greater illumination than machine shops except where striping and more exact work is done. Storage rooms and warehouses require only a low intensity, except along the gangways where much trucking is done; sixteen-candlepower lamps sixteen feet apart under flat shades answer quite well. In all factory lighting reliability is the most important requirement; simplicity is second and low maintenance cost third. Mr. Newman considered particularly the conditions of a finished plant whose lighting is to be brought up to date. In such cases low first cost is usually the predominant consideration, especially if reliability and simplicity go with it. The funds for making the change are generally limited; gradual replacement is therefore desirable. This is where tungsten lamps have such a marked advantage. Mr. Newman cited a case where the old open arcs in a foundry were gradually replaced by tungsten lamps. Then other departments were similarly equipped, 100-watt lamps being used with shades made in the shops. Eighteen-foot spacings with lamps at a height of 10.5 feet and equipped with sixteen-inch porcelain enameled bowl shades were found most serviceable.

The discussion of the paper was opened by Mr. Price, of the International Harvester Company, who spoke of the great value of welfare work in promoting good feeling and efficiency in the workmen. Whitewashed rooms, clean windows, good artificial lighting and a generally cheerful atmosphere give positive advantages to the employees. There is no doubt that good lighting and sanitary features have a marked economic value.

J. R. Walter, of the Curtis Publishing Company, stated that the work of illuminating engineers is of a philanthropic nature. Poor lighting is a decided detriment to the employees and to the quality of work done. Women employees are particularly prone to suffer from the evils of poor lighting.

Mr. Frost, of the Santa Fe Railroad, said that increased efficiency of the men, reduction of accidents and increased output of the shop are the three most valuable features of good shop lighting. He believed more attention should be given to general lighting.

Mr. Hunt, of the Arnold Company, believed that general lighting has a particularly valuable effect on the efficiency and behavior of the men.

A. Scheible asked whether any data have been collected on the cost of accidents caused by poor lighting. Chairman Pearson spoke of an attempt along this line that had to be given up because of the impossibility of positively determining the causes of accidents in so many cases. Mr. Price cited a large manufacturing company, now well known for welfare work including good lighting, in whose works in the year 1900 about forty-three per cent of its men lost one day or more due to injury; in 1909 only nineteen per cent of the men lost a day or more for the same reason.

Mr. Newman said he has a regular force for cleaning the fixtures. In the foundries they are cleaned at least once a week. Tungsten lamps are cleaned while lighted and there has been little breakage from this cause.

Searchlights and Flaming Arcs in Use on the Panama Canal.

The use of searchlights and flaming-arc lamps is greatly facilitating the construction of the Panama Canal in the vicinity of the Gatun dam. Barges filled with sand and rock are now unloaded also at night at the Gatun docks where there are two duplex and one single cableways for this purpose. On the tail towers of each cableway there is mounted a searchlight which throws its beams along the cables and over the storage piles to the barges at the dock. These searchlights are eighteen inches in diameter and are operated at 125 volts from the head towers. Between each pair of tail and head towers there are strung four flaming-arc lamps with converging electrodes. These lamps serve to illuminate the irregular surfaces of the storage piles.

Since these special lighting arrangements were put in the unloading facilities at the docks have been used night and day and a noticeable acceleration of the work on the immense dam has resulted.

A recent dispatch from Guayaquil, Ecuador, states that the local electric light company has increased its capital and is making considerable extensions.

TELEPHONY—TELEGRAPHY, and WIRELESS.

TELEPHONE TRAIN DISPATCHING. V.

THE APPARATUS EMPLOYED.

BY K. W. ENDRES.

Railroad dispatching service has been responsible for the development of several entirely new types of telephone apparatus. Combining as it does the features of both long-distance and rural lines, the equipment ordinarily employed on these types of circuits is not at all suitable for the novel conditions of railroad work.

It is hardly possible for the telephone engineer used to the commercial end of the business to conceive of having a 200-mile circuit with the possibility of from two to fifty stations listening upon it at once. It is equally hard for him to understand how these stations may all be called selectively, and yet the accomplishment of both these results has been a primary essential in this work.

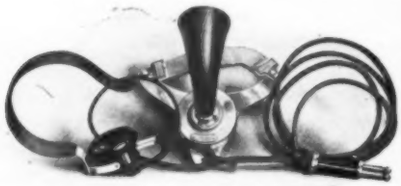


FIG. 1.—DISPATCHER'S TELEPHONE SET.

The development of new apparatus has proceeded along three parallel lines. The first of these was, of course, the instrument development; the second and most important the design of a selective device which would permit a dispatcher to signal any one station without ringing the bell at any other; while the third has been occupied in bringing auxiliary apparatus to the same stage of perfection that the line equipment itself had already reached. With the most expert engineers in the country working for the same end and all after the future growing business that there will be with the railroads for such equipment, it is not strange that the art has advanced so rapidly and that such wonderful results are being obtained today in all parts of the country with the railroad telephone.

The design of new instruments to give an increased transmission efficiency over the commercial sets was necessitated by the fact that so many receivers would be bridged across the line. Therefore the railroad telephone-transmitter contains a special button which cares for this feature. The dispatcher practically always uses the head and chest set shown in Fig. 1. It is the general practice to have him connected to the circuit at all times, so that any operator can always reach him promptly. For this reason he is equipped, like the ordinary switchboard operator, with apparatus easy to wear continuously.

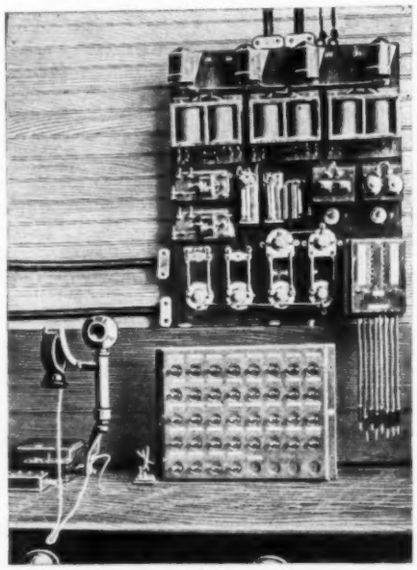


FIG. 2.—TERMINAL EQUIPMENT AS USED ON SOUTHERN RAILWAY.

There is also provided at the dispatcher's office terminal apparatus required in the operation of the circuit, as has already been explained in the preceding articles. This is all standard apparatus such as is in daily use in telephony, although the circuit combinations here are much different. Such equipment, as installed on the Southern Railway, is shown in Fig. 2.

The dispatcher, being connected across the line permanently and talking on the circuit a large part of his time, places a nearly constant drain on his talking batteries. Therefore the practice is quite general of employing storage batteries for this office, four volts usually being sufficient. Arrangements are made so that two sets of batteries are used, one being charged while the other is in use.

At the way stations any one of several types of equipment may be employed. All, however, use the high-impedance receiver and the more efficient transmitter, together with the special talking circuit and induction coil devised for this work.

FIG. 3.—WAY-STATION DESK STAND.

Perhaps the apparatus in most general use is a modification of the familiar desk stand. In railroad service where a man has to be receiving long messages, a head set is provided instead of the hand receiver.

The desk set is, of course, popular both on account of convenience and price, but the flexiphone arm runs it a close second. This arm permits the telephone to be raised against the wall or rotated out of the way as desired and is a great convenience in busy stations.

A novel design of telephone arm has also been brought out solely for railroad service. It was found desirable

to have a device from which a tower man could get away quickly in order to operate the interlocking switches, and the ordinary head set delayed him. Mr. Van Akin of the New York Central Lines brought out the arm shown in Fig. 5, which is known by his name. The transmitter and receiver are held in the proper position and are adjustable to different sized heads. The base of the arm contains commutator

FIG. 4.—FLEXIPHONE IN USE FOR DISPATCHING.

switches arranged so that when the arm is pulled around into the operating position, the telephone circuit is connected to the line. Normally it is open.

Coming now to the important feature of a telephone train-dispatching system, the selector, it may be said that there have been a large number of these devices developed, but those which have proved successful in practical operation can be counted very quickly.

The selector is the electromechanical device by means of which the dispatcher is able to signal the station he wants without calling any other station. One is placed at every way station and at the dispatcher's office is a corresponding key to operate it.

The selector must not only be able to select, as its name indicates, but it also must not affect the telephone line in any harmful way as regards talking. It must be possible to connect as many of these instruments to the circuit as may be desired and transmission must not be affected. This, of course, means a very careful electrical design, unless expensive auxiliary apparatus is to be used and the selectors in general use at present—all of the bridging type—meet this condition in a most satisfactory manner.

There are two selectors of the individual-call type in extensive use. The Western Electric selector is the newest of these and although only recently placed on the market has proved very reliable in operation besides being of extreme simplicity. Its use has spread to the various sections of the country and some of the largest railroads, as well as those which have gone into the dispatching question most carefully, are using it. This selector is shown in Fig. 6.

This apparatus consists of two electromagnets which are bridged across the line in series; one of these acts slowly, the other normally at high speed. The moving parts consist of two steel pawls, each attached to a magnet armature, which engage a ratchet wheel to which a contact is fastened.

The dispatcher's key sends out first a long impulse of current, then the necessary number of short impulses for the signal. The first impulse pulls up the armatures of both magnets; the remaining impulses operate the quick-acting magnet, but do not affect the other one which remains held up by them. The pawl on the magnet which remains held up engages the ratchet wheel and prevents its falling back, the pawl on the other magnet steps the wheel around

FIG. 5.—VAN AKIN TELEPHONE ARM.

the proper number of teeth. The two contacts then close and the station bell is rung. After current is taken off the line at the dispatcher's office, either by the completion of the normal operation of the key or by his releasing the strap key (with which he may hold the ring) everything is returned to normal position when the magnets release.

Any selector of this type may be adjusted for any station on the line merely by changing the position of the moving contact relatively to the ratchet wheel. It is thus of a universal type, which is a very desirable feature in times of emergency.

This selector requires about ten milli-amperes at thirty-seven volts for operation and calls at the rate of about one second per ten stations. It is sealed in a glass, dust-proof cover, but can be easily opened for maintenance work, if desirable.

The second type of the individual-call selector is the Gill. This is used among many different railroads at present and has proven quite reliable and satisfactory. This selector is used in connection with a method of operation similar to the preceding. It also is a special modification of the ratchet and

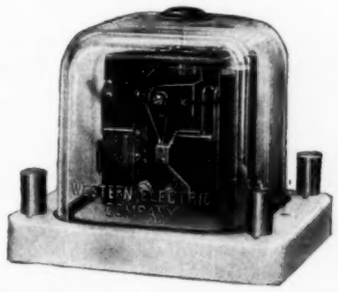


FIG. 6.—WESTERN ELECTRIC SELECTOR.

pawl principle, but is entirely different from the first selector described.

This apparatus started out in the first days of telephone dispatching on a series basis, but all selectors now are bridged across the line. This is analogous to an electric lighting circuit, where the burning out of one lamp affects it alone; the same thing is true of the bridging selector system.

With the Gill selector the dispatcher's key delivers to the line a succession of impulses and intervals, generally in four figure combinations. The selector on the line corresponding to this combination steps its ratchet wheel clear around so that contact is made and the station bell rung. All other selectors will fail to step their wheels around, because the wrong combination of impulses (for them) coming over the line will have caused the pawl to slip out at some point of the revolution and the wheels will have returned to normal. The details of the clockwork mechanism for accomplishing this result are very complicated and cannot be described in the space available. This, however, is not an essential, since repairs are always made by the manufacturer.

The selector can be made of either the central-energy or local-battery types, but in the former case the dispatcher holds the ring to make it continuous, while in the latter it rings until he stops it. The answer-back feature is obtained on this selector by means of inductive windings on the selector magnets.

These selectors require about ten milli-amperes at forty-six volts for operation. Their speed of operation is

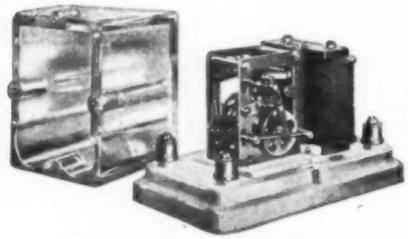


FIG. 7.—GILL SELECTOR.

about eight seconds, irrespective of the location of the station. The selector is sealed and cannot be opened. Repairs are cared for by substituting new apparatus and returning that out of order.

Both the above types of selector will operate on considerably less than the ten milli-amperes given above, but that figure is the customary one used in figuring such circuits in order to make

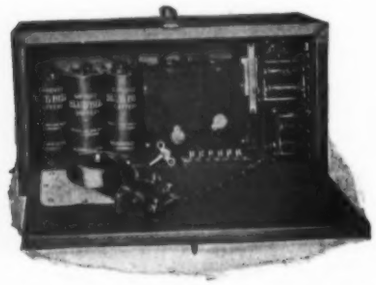


FIG. 8.—CUMMINGS-WRAY SELECTOR.

sufficient allowance for the line leakage which occurs in wet weather.

The only successful multiple-call apparatus in service is the Cummings-Wray selector. This is based on the principle of synchronous clocks. It, of course, has the objection that all clocks on the circuit must be wound once a week. Nevertheless it is in use to a considerable extent in the West, although the indications point to a discontinuance of this system of calling.

The circuit operation of this system has already been described. The actual apparatus consists of an electrically controlled clock mechanism and a number of ordinary telephone relays. These all have to be adjusted occasionally. Local battery is installed in the selector set for their operation.

After the dispatcher has pressed the keys he wishes and operated the starting key, the clock mechanism revolves the contact arm around the circle of contacts, completing the revolution in one minute. The first stations are, therefore, called more quickly than the last ones. The bell rings until stopped by the way-station operator The current taken by each selector is one milliampere at six volts.

With the apparatus outlined above, it is possible to operate a train-dispatching system by telephone, but in case of storms, line breaks and other troubles it is desirable to be able to make simple tests and patches on the circuits. It is also desirable to be able to use several circuits through the same office. How this is done will be taken up in the next chapter.

(To be continued.)

Public Service Rates and the Investor.

Prof. Dugald C. Jackson of Boston, the well-known consulting electrical engineer, gives the following clear explanation of the difference between the ordinary manufacturing corporation and the public-service company in regard to the apparent interest rates on the money invested in the two different types of enterprise. He says:

"Interest on the investment has a much larger influence on the rates of a public service corporation than ordinary mercantile experience might lead one to believe. Merchants, bankers, and other business men expect to turn over their capital every year, and it is not unusual in mercantile business to turn it over several times a year. This reduces the proportion with which the interest on investment enters the prices which must be charged to customers, because the interest is spread over sales aggregating from one to many times the amount of the capital. In most manufacturing branches it is likewise common to turn out annual product of value greater than the capital invested. If the value of product made and sold in a year is twice the amount of the invested capital, it is obvious that ten per cent profit on the value of the product, earned above all manufacturing costs and charges, means twenty per cent profit on capital.

"On the other hand, most public-service companies are situated under conditions quite the contrary from those pertaining to the projects of general business and manufacturing. Instead of making a gross annual income equal to or exceeding the capital investment, an electric light company ordinarily must expend a sum of money in establishing its plant and business which is not less than three or four times the annual gross income that it may expect to receive, and which must often be from four to six times the gross annual income. This at once multiplies the influence which interest on capital exerts when charges for service are to be determined, which is exactly the contrary of the conditions which pertain in most of the branches of general business and manufacturing. A public-service corporation of this character, therefore, cannot do business on the usual margin of general 'manufacturing profit' and live; but a larger proportion of its annual gross income must inevitably be available for meeting the demands of interest, or the project will fail."

Boats to Be Equipped with Wireless Apparatus.

In accordance with the recent act requiring sea-going vessels to be equipped with wireless a number of sets are to be installed on vessels of various lines. The United States Wireless Telegraph Company's system will be placed on the following:

The Havana Coal Company's *Berwindwale* and *Berwandmoon;* Sudden & Christensen's *Norwood* and *Cephalis;* the Pacific Navigation Company's *Yale* and *Harvard;* J. Homer Fitch's *Carlos;* Marquette & Bessemer Company's car ferries, No. 1 and No. 2; the American-Hawaiian Steamship Company's *Honolulian* and the Union Oil Company's *Whittier, Roma* and *Thomas.* Arrangements for other steamers are being made.

Wireless Record at Sea.

In his recent wireless experiments on board ship, Marconi succeeded in receiving messages from the Clifden and Glace Bay stations at a distance of 3,500 miles, in daylight. A kite was used to support the aerial. The greatest previous distance for reception of wireless messages on board ship in the daytime was only 1,750 miles, or half the above.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

NORFOLK & PORTSMOUTH TRACTION.

The report of the Norfolk & Portsmouth Traction Company for the month of August and two months ended August 31, compares as follows:

	1910	1909
August gross	$188,834	$174,211
Expenses	100,500	96,336
August net	88,334	77,874
Charges, taxes, etc.	64,865	63,118
August surplus	23,469	14,756
Two months' gross	385,732	354,438
Expenses	207,553	197,499
Two months' net	178,179	156,938
Charges, taxes, etc.	131,442	126,469
Two months' surplus	46,737	30,469

AURORA, ELGIN & CHICAGO.

The report of the Aurora, Elgin & Chicago Railroad Company for the month of August and two months ended August 31, compares as follows:

	1910	1909
August gross	$178,730	$163,698
Expenses	87,476	76,448
August net	91,254	87,250
Charges and taxes	33,039	29,351
August surplus	58,214	57,899
Two months' gross	361,117	331,312
Expenses	175,088	154,343
Two months' net	186,029	176,969
Charges and taxes	65,608	58,250
Two months' surplus	120,421	118,719

EDISON ELECTRIC ILLUMINATING COMPANY OF BOSTON.

The annual report of the Edison Electric Illuminating Company of Boston for the year ended June 20, 1910, compares as follows:

	1910	1909
Gross	$4,709,456	$4,111,342
Expenses	*2,688,720	*2,766,029
Net	2,020,736	1,345,313
Miscellaneous income	80,202	45,360
Total income	2,109,938	1,390,673
Interest	166,777	86,846
Balance	1,934,161	1,303,827
Miscellaneous charges	85,511	20,797
Balance	1,848,650	1,283,030
Dividends	1,555,596	1,424,389
Surplus	293,054	†141,359

*By change in bookkeeping, charges for depreciation in 1909 and 1910 were not included in operating expenses as in former years.
†Deficit.

INTERBOROUGH RAPID TRANSIT.

A report recently prepared by the officials of the Interborough Rapid Transit Company, of New York City, shows among other things that the combined subway and elevated lines carried nearly 300,000,000 more passengers from July, 1909, to July, 1910, than the elevated did for the same period the year before the subway was opened. The table for the past five years is as follows:

PASSENGERS CARRIED.

Year.	Subway.	Elevated.
1906	137,919,632	257,796,754
1907	166,363,611	282,924,273
1908	200,439,776	282,845,864
1909	238,430,146	276,250,196
1910	268,962,115	293,826,280

AMERICAN TELEPHONE AND TELEGRAPH.

The American Telephone and Telegraph Company and associated holding and operating companies, not including connected, independent, or sublicensed companies, report for the eight months ended August 31, 1910, with all duplications, including interest, dividends, and other payments to the American Telephone and Telegraph Company excluded, compared as follows:

	1910	1909
Gross	$108,095,987	$96,699,882
Expenses and taxes	40,482,249	36,268,757
Balance	67,613,738	60,431,125
Maintenance and depreciation	35,025,826	29,399,582
Net	32,587,912	31,031,543
Interest	7,560,171	7,144,184
Surplus	25,027,741	23,887,359
Dividends	16,841,531	15,909,690
Surplus	8,186,210	7,977,669

The unexpended portion of the provision made for depreciation for the first eight months of 1910 was $13,122,136, which is not counted as profits, but remains as a reserve for future replacements.

The report of the American Telephone and Telegraph Company for the quarter and nine months ended September 30, 1910, compare as follows:

	1910	1909
Dividends	$4,913,072	$3,912,697
Interest other revenue	2,659,636	2,825,841
Telephone traffic	1,037,738	1,095,710
Real estate	24,303	23,375
Other sources	80,867	254,957
Total	8,714,616	8,112,585
Expenses	884,416	603,016
Net	7,830,199	7,509,562
Interest	1,249,941	1,536,138
Surplus	6,580,259	5,973,424
Dividends	5,197,035	4,332,467
Surplus	1,383,220	1,640,958

January 1 to September 30:

	1910	1909
Dividends	$14,115,398	$11,036,612
Interest other revenue	8,311,128	7,980,364
Telephone traffic	3,602,966	3,184,839
Real estate	73,045	72,866
Other sources	207,973	1,050,728
Total	26,310,511	23,325,410
Expenses	2,578,901	1,829,969
Net	23,731,609	21,495,441
Interest	3,836,296	5,428,761
Surplus	19,895,313	16,066,679
Dividends	15,549,388	11,963,758
Surplus	4,345,925	4,102,921

American Telephone and Telegraph Company reports for three and nine months ended September 30:

	1910	1909
Three months' net	$ 7,830,199	$ 7,509,562
Nine months' net	23,731,609	21,495,441

American Telephone and associated companies report for eight months ended August 31:

Net	$32,587,912	$31,031,543

CHICAGO & MILWAUKEE ELECTRIC.

The Chicago & Milwaukee Electric Railroad reports for the three months ended August 31: Gross, $331,970; net, $150,432; other income, $263; total income, $150,695; taxes, interest on receivers' obligations, etc., $44,297; balance, $106,398.

The forthcoming Chicago & Milwaukee Electric reorganization announcement is likely to include a $3,000,000 bond issue covering $1,080,000 Illinois division underlying issue overdue, also receivers' certificates and other obligations.

AMONG THE CONTRACTORS AND SUPPLY MEN

To know what is going on among the men who do things and those who supply the material for the doing is always interesting. The actual happenings of the day with the contractors and the men who furnish them with supplies of all kinds, accurately reported from all parts of the country, is the object of this department.

LIN. M. BROWN, Greenville O., was awarded the contract for wiring the town hall at Ansonia, O.

LOVE BROTHERS, Aurora, Ill., secured the contract for the fixtures for the new lighting system to be installed in Peru, Ill.

THE MONARCH ELECTRIC COMPANY, Kansas City, Mo., has been awarded the contract for furnishing electrical supplies to the penitentiary at Leavenworth, Kans.

A. E. MURRAY of Grand Forks, N. D., announces that he will re-enter the electrical supply business. The business will be conducted on a larger scale than the one was which he disposed of some time ago.

THE LLOYD LIGHTING COMPANY, Oneonta, N. Y., was recently formed to deal in lighting appliances and supplies. The directors are John F. Lloyd, Clarence C. Miller and Chauncey W. Herrick, all of Oneonta.

THE CENTRAL MACHINE & REPAIR COMPANY, Portsmouth, O., will be conducted by Geo. Youngman and Edward Stevens, who purchased the business from Mr. Brunner. Mr. Brunner recently left Portsmouth, sailing for Europe.

THE HENLEY ELECTRIC COMPANY, Bloomington, Ind., has completed a $5,000 contract at the new Science Building of the Indiana University. The Company has in addition finished several other contracts and has been awarded one amounting to $2,000 by the Hotel Tourner.

WAITT & SOCKETT, of Lynn, Mass., recently rewired Abbott Hall at Marblehead, Mass., and are also installing new lamps. The auditorium will be equipped with tungsten lamps.

The stage has been equipped with new footlights and the exits with tungsten lamps, as a separate circuit. A new and complete switchboard will be installed, and in addition to other lighting, there have been fourteen four-watt tungsten border lights placed over the stage.

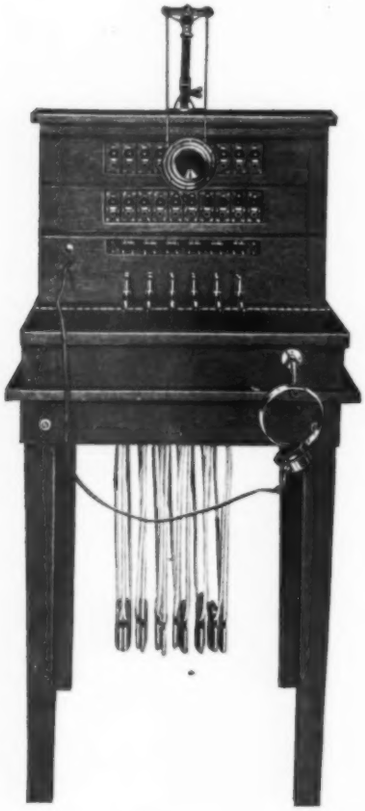
New Electrical and Mechanical Apparatus and Appliances.

An Innovation in Small Switchboard Construction.

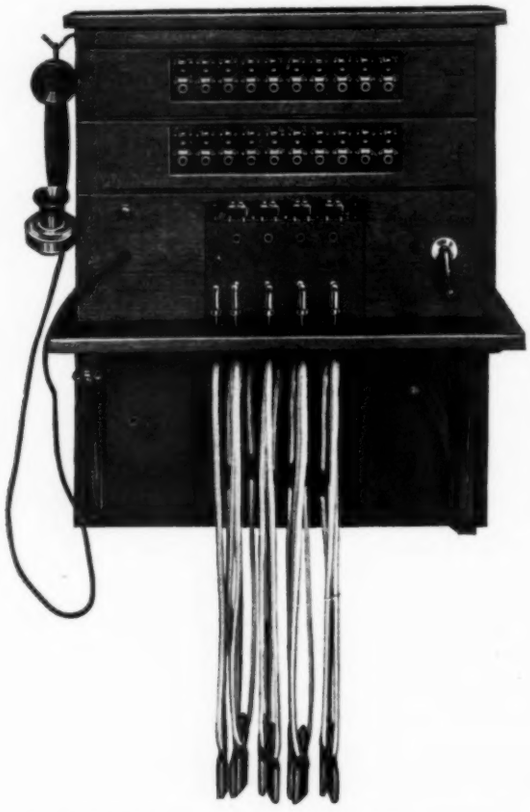
A novel type of small telephone switchboard capable of being not only easily increased in capacity but at the same time readily convertible to suit various service conditions has made its appearance on the market.

The telephone company that operates a small exchange is confronted with the problem of selecting a switchboard of the proper style and capacity that will meet their service conditions at the present time as well as in the future. This problem has been all the more perplexing when the telephone company is unable to determine with any degree of accuracy what their future requirements might be. Thus they have often found it necessary to either purchase a switchboard that might serve for only a short time and then discard it, or they might find at a later date that they had purchased a switchboard of such a large size that they would never be able to make full use of the same.

This and other problems have been very cleverly solved by the Western Electric Company with the design of its new unit type switchboard. It will be noted from the illustrations that this switchboard is built up of several separate units, comprising the following: Top units, line units, cord units and supporting units.



CONVERTIBLE SWITCHBOARD—FLOOR TYPE.



CONVERTIBLE SWITCHBOARD FOR WALL SERVICE.

As the telephone company's requirements increase, so can the switchboard capacity be increased, and at all times the telephone company has a minimum investment.

The top units can be supplied with either a hand telephone set or a suspended transmitter. The line units can be supplied with either self-restored jacks and signals, manually-restored drops and jacks, ringers, through toll-line apparatus, etc. The cord units can be supplied with either listening jacks and supervisory drops or ringing and listening keys and supervisory drops. They can further be furnished with the following different features: Single supervision; single supervision, non-hang-up; single supervision, non-ring-through, non-hang-up.

The supporting units can be supplied of three general kinds: For wall type of switchboard; for floor type of switchboard; and for desk type of switchboard.

Many small switchboards are located in business places or private homes, where the operator has other duties to perform. Under such conditions a wall type of switchboard, equipped with a hand telephone set, is found the most desirable.

As the telephone company's business increases the operator may be required to be seated at the switchboard the greater part of the time, and, therefore, a floor or desk type of switchboard having a suspended transmitter is quite essential.

With the sectional unit scheme, a switchboard cannot only be increased in capacity but it also can readily be converted to any desired type.

There are many hundreds of switchboards that are capable of giving several years of good service that are stored away because the telephone companies have no further use for them, since they no longer fit in with the new order of things. Such switchboards are unquestionably a bad investment, because the telephone company did not realize the full value from the same. On the other hand, this new unit type of switchboard would be a good investment, since on account of its elasticity a place of service could always be found either in the whole or in part.

All of these units are especially designed so that they can be easily assembled and installed with unskilled help. Screw-type of terminals are provided for all of the line wire connections. All electrical connections between units are automatically made by means of the machine screws that hold the various units together, thus it is impossible to connect them up wrongly.

The design of this switchboard has been carried out in a very comprehensive manner. This series includes a total of thirty different units, which enables the telephone company to meet every legitimate condition.

Galveston-Houston Electric Railway Car Order.

An order for twelve interurban cars for the Galveston-Houston Electric Railway has been placed by the Stone & Webster Engineering Corporation. It includes ten passenger cars and two express cars, all to be built by the Cincinnati Car Company.

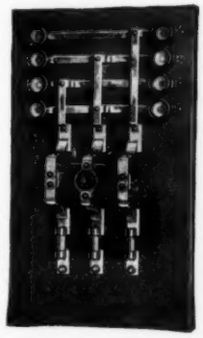
The passenger cars are fifty-two feet over all, and will seat fifty-four passengers. They are for single-end operation and are provided with smoking compartments.

They will be mounted on Baldwin M. C. B. trucks, having Symington ball-bearing center plates and steel wheels with a wheel base of six feet. General Electric equipments with automatic relay type "M" control will be used. The air brakes will be of the Westinghouse type.

The equipment of the express cars will be similar, but they will be designed for double-end operation.

A New Panel-Board Type of Remote-Control Switch.

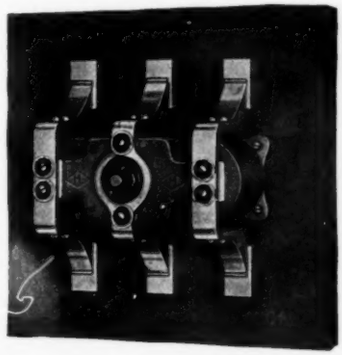
The utilization of the remote-control switch is limited only by the ingenuity of the inventor and the mechanic to discover opportunities for the adaptation of this very satisfactory means of controlling a group of lights or motors from one or more distant points. The reliability of remote-control devices has



REMOTE-CONTROL SWITCH MOUNTED ON REAR OF PANEL.

been well established and their application has been endorsed by the most successful engineers and the most critical of examining boards of fire underwriters.

In line with the development of this character of apparatus the Hart Manufacturing Company, Hartford, Conn., to whom is due large credit for the successful application of remote-control devices, has placed on the market a new panel-board type of remote-control switch. The accompanying illus-



REMOTE-CONTROL SWITCH MOUNTED ON FRONT OF PANEL.

trations show the switch mounted for back connections and also a switch mountel on a front connected panel board.

The control solenoids and locking mechanism are located in a cast-iron base. The locking device is practically frictionless and is so designed as to be absolutely reliable. The switch is neat in appearance, takes up but a small amount of space and can be mounted in any position. The spacing of the laminated brush contacts are such that it does not necessitate any deviation from the standard spacings of the buss bars in mounting the switch on the panel.

Georgia Railroad Installs Telephone.

The first step in the south of a movement which is gradually spreading over the country today has recently been accomplished on the Georgia Railroad. Telephone equipment has been installed over practically the whole of this road to replace the familiar telegraph for train dispatching.

The line from Augusta to Atlanta, a distance of 171 miles, is equipped with twenty-eight regular stations and five siding telephones. The line from Camak to Macon, a distance of seventy-four miles, is equipped with twenty regular stations.

A heavy copper telephone circuit of wire weighing 210 pounds to the mile is installed, and over this the trainmen and operators obtain a grade of transmission of speech which is even superior to that given on commercial long distance connections.

The way stations on the Georgia Railroad are equipped with flexiphones, a convenient design of telephone arm which permits the instrument to be swung back against the wall or rotated in vertical and horizontal planes. Test boards are located at regular intervals along the line to enable all the ordinary tests usually made on a circuit of this character to be accomplished.

The telephone method of handling train movements is installed on between 25,000 and 30,000 miles of railroad in the United States and is rapidly spreading. It has been found to be absolutely safe, as well as much quicker than the telegraph. The ability of anyone to receive messages transmitted in this fashion is a strong advantage. The use of portable telephone sets on trains forms a feature which is rapidly becoming invaluable to the operating railroad man.

The telephone equipment which has been installed on the Georgia Railroad was purchased from the Western Electric Company, which has supplied over ninety per cent of this type of apparatus now in use in the United States.

Electrolytic Lightning Arresters.

Many devices have been placed on the market for the protection of electric equipment from abnormal voltage on the line, due to lightning or any other cause. A most effective piece of apparatus devised for this purpose is that type of lightning arrester which depends upon the safety-valve action of a film on an aluminum plate. This type is commonly known as the electrolytic arrester and, in practice, consists of nested aluminum trays filled with electrolyte and submerged in oil.

The electrolytic lightning arrester very closely resembles in action a relief or safety valve. The horn gaps which are between the arresters and the line break down on over voltage and if this voltage amounts to over approximately 330 volts per tray, a free passage through the film from tray to tray and thence to the ground is provided. When the voltage drops to normal, which is below the critical voltage of the tray, the apparent resistance of the film reasserts itself and the flow of the current is cut down so that the horn gaps disrupt the arc and all further flow of current ceases.

The nested trays are placed in oil-filled, welded steel tanks, which, for 22,000 volts and above are built with cast covers and outdoor terminals, so that the entire arrester can be placed outdoors. The complete arrester consists of four tanks mounted on an insulated platform for ungrounded neutral service, and three tanks grounded for grounded-neutral service. For 13,200 volts and under the arrester is arranged for indoor service only, as the horn gap setting is so small that much more effective service is obtained when the arrester is housed. For the lower voltages the general arrangement of trays is the same, but a smaller number of tanks is used.

Since, when the electrolytic type of arrester is allowed to stand without current passing through it, the film on the plates dissolves, it is necessary to periodically pass current through the arrester in order to keep the film in the best condition. This prevents an abnormal rush of current when the arrester discharges after a long period of idleness.

The rate of dissolution of the film depends upon the kind of electrolyte used and the temperature. There are two kinds of electrolyte made by the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa.; one which requires that the horns be bridged daily to pass current through the arresters, and the other which requires that the horns be bridged only every seventh day. The latter electrolyte has been known to stand without current for very long periods during cold weather, and when the horns are bridged no undue rush of current followed.

When arresters are bridged at normal voltage, a bluish, crackling static arc indicates the normal condition of the arrester. If the arc is reddish and fluffy, and rises high on the horns, it is evident that the bridging of the horns has been deferred too long a time, and it will take a short period before the arc comes down to normal.

The horn gaps and bridging device are mounted on a two-inch pipe frame, to which is also attached the transfer switch used for interchanging a ground and phase tank on ungrounded neutral arresters. The bridging device is very simple and can be operated from either end.

As the voltage increases the number of trays in the arrester also increases. Hence, for a higher voltage, if the trays were all built in a continuous structure, it would be very awkward to handle and require considerable overhead room when installed indoors. For this reason, on all arresters above 13,200 volts, the Westinghouse tray structure is built up into sections containing not over fifty trays, which slide into place, one above the other, between guides supported by a base casting fitting closely to the bottom of the tank. Each section when filled with electrolyte can be easily handled without danger of upsetting it. The electrolyte is poured into the trays by means of a measuring cup, which contains the correct amount of liquid for each tray. When a section of trays is filled the electrolyte is plainly visible.

All parts of the supporting frame directly in contact with the trays are made of the best grade of porcelain; hence, any danger due to burning supports, which is likely to be present in case wood is used, is entirely eliminated.

If, when the horn gaps are set to get the maximum protection from the arrester, a ground on one phase occurs, the horn gaps connected to the other phases will discharge until the line is cleared, or is thus subjected to a continuous discharge that may last a long time. The Westinghouse arresters are designed with large tanks holding sufficient oil to absorb the heat of a continuous discharge lasting over a considerable period.

The tanks are built large on the diameter so that the clearance between the top tray and tank where the maximum voltage exists provides a good insulation factor of safety.

INSTALLATION OF ELECTROLYTIC LIGHTNING ARRESTER.

Electromagnets for Sugar Crushers.

E. A. Sammons, of New Orleans, La., has devised an electromagnetic attachment for sugar-cane crushers, which attracts and holds any piece of iron or steel which otherwise might get into the machinery with the cane.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, OCTOBER 7.—Competition between electricity and gas in London has never been so keen as it is at present, and the advertising efforts on both sides are most instructive. In many places may be seen, almost side by side, the legends that "gas is cheaper than electricity," and also "electricity is cheaper than gas;" the effect upon the minds of the ordinary public being no doubt rather amusing than convincing. A curious instance of the lengths to which the competition has gone occurred at Islington, where some of the corporation's metal filament lamps used for street lighting, have actually been removed by employes of the gas company, for testing, it is said. Obviously, for whatever the purpose, the act was grossly illegal, and although an apology has been tendered, it would not be surprising if an action were instituted.

A company has been formed to work the system of telephoning to and from trains while in motion, which was referred to in these notes a short time ago. The London, Brighton & South Coast Railway has decided to fit the system to one of its express trains. The invention is now known as the railophone.

It is stated that a system of wireless communication on the Fessenden system, is to be installed between Great Britain, Canada and the West Indies. A speed of 250 words per minute is said to have been achieved with the Fessenden system and, due to this, the figure of one cent per word has been mentioned as the probable tariff.

The Postmaster General is continually engaged in legal fights with local authorities, especially in the Greater London area, upon the question of whether telephone wires should be placed underground or overhead. Where a local authority objects to poles, the point is referred first to the County Court, and then, if necessary, to the arbitration of the Railway and Canal Commissioners. It is very seldom that the Postmaster General loses. Recent cases have arisen at Croydon and Tottenham, while the Fenekley Council has this week referred a case for the decision of the local court. While subscribers complain of the high cost of the telephone service of this country, the local authorities, who frequently take the lead in these complaints, have no compunction in increasing the capital cost of providing that service by insisting upon underground wires.

Although there is a company in the north of England doing very well, generating electricity by means of waste heat from furnaces, a great deal of progress in this direction has not been made in England. The West Hartleport Corporation, however, proposes to utilize the waste heat from some local furnaces and to erect a new power house at a cost of about $100,000 for the purpose. The present steam plant at the corporation's existing power house would be used as a reserve. The Electricity Committee has unanimously approved the proposal, and, should it pass the Corporation, then the price for the use of the waste heat will probably be a supply of power to the iron works in question.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, OCTOBER 7.—The Southern Railroad Company of France is taking measures to apply electric traction on one of the sections of the Bayonne-Toulouse line. The section lies between Tournay and Capvern, and owing to the heavy grades on this part of the road, there is considerable difficulty in carrying on the traffic. A special type of steam locomotive had to be used here. It was decided not long since to equip the section so as to allow of using electric locomotives as well as motor cars, and the single-phase system will be used. Substations along the line will furnish current at 12,000 volts to the trolley wire, and the locomotives will carry transformers for reducing the voltage for the motors. It is intended to use 1,200 horsepower locomotives of ninety tons as well as motor cars carrying four 125-horsepower motors. The company expects to erect three hydraulic plants, which will furnish three-phase current upon the power lines running to the substations, at 55,000 volts. One of the turbine stations will be located at Eget, where an artificial basin can furnish a fall of 750 meters. The second plant will be erected at Pierrefitte, and the third at Eaux-Chandes.

Among other electric traction projects in France, I note a twenty-two-mile electric railroad, which will run from Belfort to the town of Lure, as well as the tramway line to be built in the Jura region between Morez and Longchaumois.

It is expected to obtain about 25,000 horsepower from Silser Lake, in the Upper Engadine, Switzerland, and a commission has been appointed for the purpose. A turbine plant will likely be erected in the Bergel valley. Power lines will run to the Engadine, the Graubunden canyon and also give a supply for the Rhätische railroad.

A project is on foot in Germany for using the Saarbruck mines in order to give a current supply upon a network of lines. A syndicate is to be formed which includes the mining company and the Allgemeine Electricäts Gesellschaft of Berlin, and this latter is to install the plant. It is intended to erect a network of power lines, which will give current over a sixty-mile radius in the Rhine province and the Palatinate.

The Turkish Government is making arrangements with the Marconi Company for a wireless telegraph station to be erected at San Stefano. It is also intended to use wireless outfits upon eleven of the battleships. The Italian Government is to install six wireless posts in the colony of Benadir. The Compagnie Française, of Paris, has recently installed a wireless station of some size at Barcelona.

A light electric railway will be run from Rome to Anticoli and Frosinone, a distance of eighty-five miles. It will have a branch running to Frascati. The electric tramway and the electric lighting companies of Leghorn are taking measures to install electric traction on the present steam railroad which runs from Pisa to Marina, and have already purchased this line.

In Russia there will be built an electric traction line between Sebastopol and Alushta. A project is also on foot for an electric railroad from St. Petersburg to Imatra, and the current will be supplied by a hydraulic plant. A. DE C.

CANADA.

(Special Correspondence.)

OTTAWA, ONTARIO, OCTOBER 15.—The proposal to reduce the telegraph rates in Canada to twelve cents for the ten-word telegram now charged twenty-five cents, will involve a long drawn out fight with the telegraph companies. The question of a uniform rate for all over Canada has also been considered but such a radical change is not deemed advisable at the present time.

The president of the Montreal Street Railway has notified the civic officials that he would recommend that the shareholders of the company sell out as soon as the city is prepared to take over the property. No price was suggested, but it is rumored that the company will demand $150 per share, which is now quoted at $128 on the Toronto stock market. A vote of the people will probably be taken on the question of buying out the street railway system.

Advices from the city of Winnipeg state that representatives of various municipalities throughout the province of Manitoba have requested the Government of that province to secure a power site, install a plant, operate it and sell electric power to municipalities at cost. Should the Government be unwilling to do this, then it will be asked to investigate the question and guarantee the bonds of a strong company, and secure from it a guarantee that it would supply the power desired at a reasonable price.

In December next, the city of Toronto will take the first step in a movement to secure control of the radial railways entering the city. The franchise of the Mimico branch of the Toronto & York Radial Railway will expire December 31. 1911, and under the terms of that franchise, the city has the right to take over the portions of the line within the city limits, upon giving two months' notice. If the city is successful in the attempt, it may be only the beginning of a movement looking toward the control of all the radial systems entering Toronto.

The Shawinigan Power Company is now said to be nearing a merger with the Montreal Light, Heat & Power Company, whatever may be the outcome of the struggle for the control of the Montreal Street Railway. The report says that the flotation will be proceeded with shortly, despite the recent outburst in Montreal of a popular opposition to mergers. The Montreal Power and the Canadian Power people are quietly biding their time until the annual meeting of the Street Railway Company next month. It is generally conceded that the latter concern is in command of the situation.

C. H. Cahan, of Montreal, president of the Western Canada Power Company, of Vancouver, B. C., says that the provisional plant of the company is operating splendidly, and that by May 1, next, the company expects to be in a position to supply more than 20,000 horsepower to Vancouver and New Westminster. The company is receiving many requests for power from American manufacturers, who propose establishing branch factories in Vancouver and vicinity, in order to obtain more easy access to the markets of British Columbia and Western Canada generally. A Pittsburg syndicate is asking for power for an industry employing 1,500 skilled workmen. W.

MEXICO.

(Special Correspondence.)

MEXICO CITY, MEX., OCTOBER 10.—La Tula Mining Company has installed ten additional motors for operating the machinery of its mines and mills in the Guanajuato district. It now uses about 400 horsepower of electrical energy which it obtains from the transmission line of the Guanajuato Light and Power Company.

The Mexico Light and Power Company will extend its transmission line from Pachuca to Capula, State of Hidalga, in order to furnish power for the mines and mill of La Cruz Mining Company. The latter company will install a complete electrical equipment in order to be ready to take the power as soon as the extension of the transmission line reaches there. It is probable that other mines and industrial plants will also take power from this transmission line.

The Amajac Mines Company, of Hostotipaquilla, State of Jalisco, has contracted with the Chapala Hydroelectric and Irrigation Company, of Guadalajara for 200 horsepower to operate its mill and taken an option for 300 horsepower additional for future needs. The transmission line of the Chapala Hydroelectric and Irrigation Company will soon be in operation to this district.

It is announced that F. T. Snyder, of the Metallurgic Engineering Company, of Chicago, will install a plant in Mexico for roasting copper ore with electric heat, generated by water power. Much interest is taken in mining circles of this country in the proposed experiment.

The Aguacate Mines, Inc., an American corporation, is installing a large hydroelectric plant on the Rio Grande, near San Jose, Costa Rica, and will construct a transmission line from the plant to its mines, a distance of twenty miles. The plant will have a capacity of 5,000 horsepower.

The Abangarez Gold Fields, of which Minor C. Keith, of New York, is president, is installing a 3,000-horsepower hydroelectric plant on the Gaucimal River in Costa Rica, and will construct a transmission line eleven miles long from the plant to its mines. D.

COMMISSION NEWS FROM NEW YORK.

(Special Correspondence.)

The New York Public Service Commission, Second District, has authorized the Huntington Light and Power Company to execute a mortgage for the sum of $250,000 and to issue bonds to the amount of $98,000 and additional capital stock to the amount of $2,000. The proceeds are to be used for the discharge of outstanding obligations to the amount of $86,000, the improvement of plant and distributing system $14,000, and $42,000 to purchase the outstanding bonds of the Huntington Gas Company at a price not to exceed seventy.

The Commission has received an application from the Hudson River & Eastern Traction Company for authority to issue $50,000 of additional common stock and $850,000 additional first-mortgage bonds. The company is now engaged in operating an electric railroad in the town of Ossining and intends to complete the construction of its line from its present terminus in the Camp Woods in the town of Ossining to the village of White Plains, a distance of approximately fourteen miles, exclusive of sidings. It is stated this will require an expenditure of $621,000.

The Commission has also received a complaint from the Lycoming & New Haven Telephone Company against the New York Telephone Company. The former company owns and operates a telephone line from Lycoming in the town of Scriba to Dempster in the town of New Haven in the county of Oswego. The line in question is about six miles in length. It is alleged that the New York Telephone Company has neglected and refused to allow patrons and subscribers of the complainant's line to use the lines of the New York Telephone Company through and beyond the switchboard of the complainant at Lycoming, although requested to do so. It is stated that the New York Company refuses to grant the service unless the complainant company will pay to the New York Telephone Company the sum of $3.00 per subscriber in addition to the tolls exacted by the New York Telephone Company, and in addition the New York Telephone Company demands that the complainant shall buy the stock of certain dissatisfied stockholders.

A preliminary hearing upon the complaint of residents of Albany, N. Y., has been given by the Commission, relative to the matter of a proposed scientific schedule of rates for electric power and gas to be charged by the Municipal Gas Company of that city to be submitted later. The complainants contended that the earnings of the company in question were far greater than they should be and stated that ten or twelve per cent upon the money invested should be sufficient for the Municipal Gas Company to charge. The matter will be further argued on October 24.

The practice of gas and electrical corporations in exacting deposits of consumers as security for the payment of bills is to be regulated by the Public Service Commission. A notice has gone out to all the companies of a hearing to be held in Albany on November 1, at which will be discussed the rules and regulations proposed to be adopted.

Authority was granted by the Commission to the Northern Power Company of Potsdam, St. Lawrence County, to begin construction and exercise franchise for the supplying of electricity in the village of Richville, St. Lawrence County.

LIGHTING AND POWER.

(Special Correspondence.)

SHELBYVILLE, DEL.—Work has been started here on a new ice and electric light plant.

GILBERT, MINN.—Bonds for $25,000 have been voted for an electric light and sewer system. P.

MARION, IND.—The construction of a municipal light plant is contemplated by the city council. S.

SCRANTON, PA.—The Paupock Power Company has been incorporated with a capital of $400,000.

CHASE, KANS.—The Chase Hardware & Implement Company will install a private electric light plant. P.

PARSONS, KANS.—A vote will be taken in November on issuance of $50,000 of electric light bonds.

BRIDGEPORT, NEB.—The Bridgeport Electric Light & Power Company has been chartered with a capital of $25,000.

DECATUR CITY, IOWA.—Electric lights were recently installed here, power being furnished by the plant at Leon.

SNYDER, NEB.—Contracts have been let for the installation of an electric light plant, and work will begin about November 1.

DENVER, COLO.—The Kraus Light Company has been incorporated by Isaac Berlin, S. F. Kraus and H. P. Swain. The Company is capitalized at $50,000.

BELLE FOURCHE, S. D.—The electric light plant recently burned causing a loss of about $20,000. There was no insurance on either equipment or building.

TERRE HAUTE, IND.—An ordinance has been introduced in the City Council providing for the establishment and operation of a municipal electric light plant. S.

FT. WAYNE, IND.—The Ft. Wayne Electric Works has completed the installation of a new switchboard and other new machinery in the municipal lighting plant.

SARATOGA, WYO.—The plant of the Saratoga Electric Light Company has been purchased by D. E. Winsor. A number of repairs will be made and the service will be improved.

PALISADE, COLO.—The Mutual Light, Power & Telephone Company has been incorporated with a capital of $50,000. The incorporators are H. L. Davies, H. R. Haugh and H. H. Younger.

SMARTSVILLE, CAL.—The Tarr Mining Company is to use electricity as motive power for its plant. A transformer has been installed and current will be supplied for lighting as well as for power.

GAINESVILLE, GA.—The Blue Ridge Power Company has been incorporated with a capital of $50,000 by W. A. Carlisle and others. The Company proposes to build a hydroelectric plant on Chattahoochee River. B.

MONTEVALLO, ALA.—Dr. R. A. Berry will establish an electric lighting plant for lighting residences and providing power for dairy and farm machinery. The plant will be established on a stream on Mr. Berry's farm. B.

INDEPENDENCE, MO.—A new turbine generating set has been installed in the plant of the Electric Light Company in this city. By this addition the capacity of the plant has been increased from 250 to 750 kilowatts.

IMBODEN, ARK.—The electric light plant, which was sold some time ago at a receiver's sale to the People's bank of this city for $1,650, has been shut down indefinitely. It is believed, however, that operation of the plant will be resumed at an early date.

ANAMOSA, IOWA.—The new 1,000-horsepower engine for the electric light plant has arrived and will soon be installed in the new power house in place of the present 150-horsepower engine. The engine is large enough to furnish power for the proposed interurban south to Olin and other points.

GLEN ALPINE, N. C.—J. D. Pitts, extensively interested in lumbering at this point, has begun operations on the construction of a concrete and rock dam four miles from this place, on Canoe Creek, where he expects to secure a development of 250 horsepower, the cost being $20,000. Power will be used for industrial and lighting purposes. L.

ALLERTON, IOWA.—The plant of the local electric light company which had been in operation but thirty days, was destroyed by fire entailing a loss of $8,000. The electrical machinery is a total loss but the power-producing portions, it is thought, may be repaired. The plant had not yet been turned over to the municipality after its final test. Z.

EMPORIA, VA.—Electric power was recently turned on by the Emporia Manufacturing Company and this company is now supplied with power from the lines of the Emporia Hydro-Electric Power Corporation. The Corporation supplies current for city lighting and has an excess of power which would be available for new manufacturing plants.

MINNEAPOLIS, MINN.—It is the plan of representatives of public organizations here to have the ornamental street lights owned and maintained by the city. The estimated value of the 373 ornamental posts is $33,000. Up to the present time the system

has been maintained by private subscriptions; about $27,000 having been donated for that use.

SILVER CREEK, NEB.—A franchise to install and operate an electric light and power plant in this town was granted to E. L. Ives, Charles W. Brown and W. Grant Brown. Work will be started as soon as possible on a building to be about 40 by 80 feet in size. The building is to contain not only the power equipment, but will also be used as a garage and repair shop.

GRAND RAPIDS, MICH.—Contingent upon the re-organization of the Grand Rapids Muskegon Power Company, extensive improvements are contemplated. Plans are being made for the extension of lines to North Park, Mill Creek, Spring Lake and from the Kent City substation to Casnovia, Sparta and along the lake front at Muskegon. The estimated cost is $200,000.

BRIGHAM CITY, UTAH.—The report of the electric light committee regarding the enlargement of the city's power plant in Box Elder Canyon was heard before a meeting of the City Council a short time ago. The committee's estimation of the cost of installing anther unit is placed at $7,814.50 for the necessary machinery and $800 for the enlargement of the power house.

SHEBOYGAN, WIS.—As a result of the fight between the City of Sheboygan and the Electric Railway & Electric Company which company furnishes it with light, the City has made a request on the Rate Commission for a license to build a municipal lighting plant. The City is willing that in the meantime the present lighting company furnish the light, the municipality paying such price as the Rate Commission may order.

SULLIVAN, IND.—The Sullivan County Electric Company has just completed a new 450-kilowatt central station and is transmitting 11,000-volt, three-phase, sixty-cycle energy to Farmersburg, six miles distant and to Shelburn twelve miles distant. The main office of the Company is at Clinton, Ind., where it has a plant doing a good business. The Sullivan plant is equipped with Fitchburg engines driving Westinghouse generators. S.

ANSONVILLE, N. C.—Looking toward the development of the northern section of Anson County, A. H. Richardson, of this place, and others, are contemplating the development of a waterpower site at Kendall Ferry, on Rocky River, fifteen miles from Wadesboro. The project includes a dam and power-house, costing $400,000 and producing 7,000 horsepower. The river is 200 feet wide at the site of the proposed dam, and on the east side the dam will extend back 300 feet. L.

MADISON, GA.—The Apalachee Power Company, of Madison, is just completing an extensive survey of its water power on the Apalachee River, under the direction of T. B. Johnson. The survey will show the entire topography of the shoal, and the extent of the proposed lake, based on an elevation of twenty-five feet at the head of the shoal, which has a natural fall of twenty-seven and one-half feet. This will give a head of over fifty feet for the proposed plant developing 1,200-horsepower.

NEWBERRY, S. C.—The Mollohon Manufacturing Company and the Newberry Cotton Mills are reported to have contracted for electricity to drive their plants. This electricity will be obtained from the Newberry transmission lines, which the Southern Power Company, of Charlotte, N. C., is now preparing to construct. About 1,200 horsepower will be required for the Mollohon mill. The Newberry mill will use about 500 horsepower for about one-third of its plant, operating the remaining two-thirds by steam power.

YORKVILLE, S. C.—On account of the reported intent of the Southern Power Company, which has been supplying power to the town for lights, etc., to increase its rates from one cent per kilowatt-hour to 1.9, according to report, the town is now said to be considering the question of completing a full plant for generating power. Yorkville already owns the equipment and the electric franchise, purchasing power only from the Southern Power Company. The five-year contract with the Southern Power Company for current expires shortly. L.

ASHEVILLE, N. C.—Announcement is made that the Weaver Power Company, operating a hydroelectric plant five miles from here, and building another near Marshville, on the French Broad River, to develop 5,000 horsepower, is making plans to carry its transmission lines to Canton, to supply 1,300 horsepower to the Champion Fibre Company, one of the largest wood and pulp-working plants in the United States. These lines will likely be carried eventually to Waynesville, to the west, and Hendersonville, to the south, to furnish power for lighting, and manufacturing purposes.

HARTFORD CITY, IND.—The Dunkirk Lighting Company has brought suit to condemn a right of way across the property of a number of citizens for a pole line on which to string wires for the transmission of electric current for lighting and power purposes. The Commissioners have granted the company a right of way in the public highways, but notwithestanding a fair price has been offered the private owners have steadfastly refused to permit a pole to be planted on their ground. The Dunkirk Lighting Company and the Hartford City Lighting Company are parts of the big system which also controls the Muncie Lighting Company and plants in a number of surrounding towns. S.

ELECTRIC RAILWAYS.

(Special Correspondence.)

BILLINGS, MONT.—The Billings Traction Company has been incorporated with a capital of $100,000, by C. J. Eddy, A. W. Patterson and J. A. Connolly, all of Muskogee, Okla.

CALGARY, ALTA.—W. D. Spence, city clerk, will receive bids up to noon, November 7, for the ties and poles to be used in the extension of the municipal street railway. C.

CEDAR FALLS, IOWA.—The Waterloo, Cedar Falls & Northern Railway has plans for the extension of its road to Dike and ultimately to Grundy Center and Marshalltown. C.

INDIANAPOLIS, IND.—The Evansville, Mt. Carmel & Northern Railway Company, of Evansville, has filed notice of increase of capital stock from $50,000 to $500,000. W. C. Brown is president.

CHICAGO, ILL.—The Chicago City Railway will extend immediately from Sixty-third street a line through the Stickney tract, to connect with the Joliet Electric near the Corn Products plant.

MINNEAPOLIS. MINN.—The Minneapolis Northern Suburban Railway Company, capital $250,000, has been incorporated by John J. McCarthy, Paul J. Marvin, and others to construct a trolley line to Little Falls, Minn. C.

TOLEDO, O.—The General Electric Company recently filed suit in the United States Courts at Toledo, against the Toledo, Port Clinton & Lakeside Railway, charging infringement of a patent on electric motor control. H.

ST. PAUL, MINN.—The St. Paul Promotion Company has started a survey for an electric line to Mankat, via Northfield, Faribault, Waterville, Elysian, Madison Lake, and Eagle Lake, with a branch to Dubuque, Iowa. C.

MOBILE, ALA.—The Mobile Light & Railway Company awarded the contract to Jett Bros. Contracting Company, Mobile, for erecting an addition to the car barn at Monroe Park. Several store rooms will also be built and about $11,000 will probably be expended. B.

SAN FRANCISCO, CAL.—The Gough Street Railway Company has been incorporated by A. J. Pon, David Livingston and Charles Loesch with a capital stock of $60,000. The new company will soon begin work on a trolley line along Gough Street connecting McAllister Street with the Market and Valencia Street lines, in this way relieving the traffic on the Fillmore Street hill.

BOGOTA, COLOMBIA.—The Bogota City Railway Company, an American concern, has received the first payment of $425,000 on the sale of the road to the municipality of Bogota, the purchase price of which was $800,000. The plant is now in the hands of the municipality, and the cars were started running amid popular demonstrations. The concession for the railroad was given to the company during the presidency of General Reves.

SHEBOYGAN, WIS.—Work has been started on an addition to the power house of the Sheboygan Electric Railway Company. The addition will be finished within two months of the time when work will be started on another addition to the power house, which will have dimensions of 30 by 40 feet. This addition will be for a new steam turbine of 1,000 kilowatts or 1,500 horsepower. The new boiler capacity will furnish the power for this new machinery.

TOLEDO, O.—The Toledo Railways & Light Company has awarded the contract for the erection of a new substation to be located on Front Street, East Toledo. It will be of brick and concrete and will cost about $15,000 with its equipment. The fourteen cables crossing the Maumee River will be lowered to a depth of thirty feet below the surface of the water, eliminating all danger from boat anchors, spring freshets and ice. The building is to be completed within sixty days. H.

OAKLAND, CAL.—Work has commenced on the construction of a new substation in the West Oakland yard of the Southern Pacific Railroad Company, for use in connection with the company's project of electrifying its Oakland and Alameda local lines. The new structure is being erected at a point where the Oakland mole lines join the inlet to the yard, and will be used to step down the voltage of the Fruitvale line. The new plant is ninety feet in length and sixty feet in width. When completed and equipped with machinery, it will cost approximately $100,000. It is expected to be finished by May of next year. A.

GREENVILLE, S. C.—A surveying party under engineer J. E. Sirrine of this city, set out recently to make a survey of the proposed route of the Greenville, Anderson and Spartanburg interurban system to Laurens and Clinton, and while it is not definitely known that this will be the route finally chosen, it is believed that branch lines at least will be built to these points. The extensive developments contemplated by the Interurban Company have given rise to much talk, and some rumors of an all-state line, reaching eastward and southward from Spartanburg and Greenville, to take in Columbia, and other cities in the middle and coast section of South Carolina, corresponding to the rumored extensions to deepwater in North Carolina, by the Piedmont Traction Company, the correlated interurban line in the state of North Carolina. L.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

BOYD, WIS.—The Yellow River Telephone Company will build some new lines this fall. C.

GREEN BAY, WIS.—The Wisconsin Telephone Company will build a new toll line to Plymouth. C.

FREEPORT, ILL.—The Bell Telephone interests have taken over the exchange of the Freeport Telephone Company. Z.

PIPESTONE, MINN.—Work has been started on the rebuilding of the local telephone exchange. The cost will be $25,000. C.

TROUT CREEK, MICH.—The Trout Creek & Calderwood Telephone Company has been incorporated with a capital of $10,000.

SACO, MONT.—The Moore Telephone Company is planning the erection of a new central office. A complete switchboard will be installed. C.

HUNTSBURG, O.—The Huntsberg Telephone Company has been incorporated with a capital of $6,000 by G. A. Bartholomew, H. A. Pinney and others.

MARSHALLTOWN, IOWA.—A vote will be taken November 8 on granting a franchise to the Merchants, Mechanics & Farmers Telephone Company. If granted the company intends to erect an automatic exchange at a cost of $100,000. C.

MONTEREY, CAL.—The Mission Home Telephone Company, which is to take over the business of the Pacific States Telephone & Telegraph Company, for the Montery Peninsula, has been incorporated by Thos. J. Field, Arthur J. Metz, E. Cook Smith, Carmel Martin and Geo. H. Gould, Jr., with a capital stock of $100,000. A.

BUCYRUS, O.—Telephone rates will be advanced about fifty per cent in this city on November 1. On account of the expense of rebuilding its plant and installing an automatic telephone system, the Bucyrus Telephone Company announces that after that date residence telephones will cost $1.50 and business telephones $3.00. H.

ATLANTA, GA.—Telephone equipment as a substitute for telegraph in train dispatching has been installed on 246 miles of the Georgia Railroad. The line from Atlanta to Augusta is equipped with twenty-eight stations and five siding telephones. The line from Camak to Macon, seventy-four miles, has thirty regular stations. B.

EUFAULA, ALA.—The Southern Bell Telephone and Telegraph Company has started the reconstruction of the toll line between Eufula and Columbus, Ga., by way of Omaha, Ga. Copper wire will replace the old iron wire used, and chestnut poles put instead of pine. This line goes along the river road and has stations at several large plantations.

WILKESBARRE, PA.—Residents of East Foster Township have formed an independent telephone company to be known as the White Haven Rural Telephone Company. It is the intention of the promoters to establish a rural service which in turn will be connected with the Bell Telephone service, giving the subscribers service all over the country.

SPOKANE, WASH.—The Western Union Telegraph and Cable Company has acquired the Continental Telegraph Company, a subsidiary concern of the Chicago, Milwaukee & Puget Sound, at a cost of $1,000,000. The transfer will be made November 1, when the Western Union will string wires over Milwaukee posts from Billings to Seattle and Tacoma.

OSKALOOSA, IOWA.—The Oskaloosa Home Telephone Company of this city has purchased a controlling interest in the property of the Iowa Telephone Company and in the reorganization which takes place J. S. Moon is retained as president and John Rand as superintendent and general manager. Many improvements will be made in the local exchange including the remodeling of the building.

SPOKANE, WASH.—The Pacific States Telephone & Telegraph Company is to start the erection of a fourteen-story steel and concrete building at the cost of $500,000 next month. Seven stories will be built at once at the cost of $200,000 and the additional stories will be added later. About $125,000 worth of equipment is to be installed. The building is to be ready for occupancy by April of next year. A.

NORTH TONAWANDA, N. Y.—At the annual meeting of the directors of the Niagara County Home Telephone Company the following officers were elected: President, A. H. G. Hardwicke of Niagara Falls; first vice-president, W. T. Ransom of Lockport; second vice-president, Benjamin L. Rand of North Tonawanda; secretary and treasurer, Miss Stacia Baker of Niagara Falls; general manager, R. Max Eaton of Niagara Falls.

RAPID CITY, S. D.—Improvements eventually intended to establish a long-distance telephone service between the Black Hills and Omaha and Chicago and Sioux City are being made by the Nebraska Telephone Company, the Bell system in the Hills. Over $10,000 worth of copper wire has been laid between Rapid City and Pierre, thus giving the Hills a copper circuit with the eastern part of the state, while a direct copper line is being laid between Hot Springs and Deadwood, and copper line will be laid between here and Deadwood, with still another between Deadwood and Sturgis.

ELECTRICAL SECURITIES.

The railroad strike in France had no more influence on the condition of the stock market than had the recent Portuguese revolution. On the contrary, stocks were extremely steady both here and abroad during the entire week. Trading has been both greater in volume and wider extended than since the July upward movement. United States Steel, Reading and Union Pacific furnished together nearly one-half of the week's large total, and these issues advanced an average of more than five and one half points. The total for the week, more than 2,700,000 shares, was an increase of fifty per cent in volume over the preceding week. Notwithstanding the report of the tonnage of unfilled orders given out on Monday by the United States Steel Corporation, showing the total as of Sept. 30 to be less, with one exception, than for any previous period, the stock advanced steadily throughout the week.

Chicago Railways Company's receipts for the first ten months of the current year increased twenty-five per cent over two years ago.

The Edison Electric Illuminating Company of Boston reports gross earnings for September of $371,948, an increase of $40,625, and net earnings of $201,005, an increase of $35,370. For three months the gross earnings amounted to $1,030,938, an increase of $152,247, and net to $535,150, an increase of $114,264.

Quotations on Pacific Telephone and Telegraph stock on the New York Stock Exchange varied last week from forty-two to forty and one-half. This company owns and controls the telephone system in San Francisco, and the extensive Bell systems throughout California, Oregon, Washington, Idaho and Nevada. The company, by a recent issue of bonds, has paid all its floating indebtedness and short-term notes, the proceeds of which have been used for permanent betterments and extensions. It is paying dividends on its preferred stock, and earning now four and one-half per cent on its common, which is the stock quoted on the New York Exchange.

DIVIDENDS.

American District Telegraph Company of New Jersey; regular quarterly dividend of one per cent, payable October 29 to stock of record October 19.

Edison Electric Illuminating Company, of Boston, regular quarterly dividend of three per cent a share, payable November 1.

Electric Bond and Share Company, common quarterly dividend of two per cent, payable October 15; also the preferred quarterly dividend of one and one-quarter per cent, payable November 1.

Western Electric Company; quarterly dividends of two per cent, payable November 1.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

NEW YORK.

	Oct. 17.	Oct. 10.
Allis-Chalmers common	10	9½
Allis-Chalmers preferred	34½	33¼
Amalgamated Copper	69⅞	66¾
American Tel. & Cable	84	80
American Tel. & Tel.	137⅞	137¼
Brooklyn Rapid Transit	78⅛	76¼
General Electric	154¾	150
Interborough-Metropolitan common	22⅜	20⅜
Interborough-Metropolitan preferred	59	55⅝
Kings County Electric	123	123
Mackay Companies (Postal Telegraph and Cables) common	95	96¼
Mackay Companies (Postal Telegraph and Cables) preferred	75¼	76
Manhattan Elevated	114¾	145
Metropolitan Street Railway	*18	*18
New York & New Jersey Telephone	103	103
Pacific Tel. & Tel.	40¼	41
U. S. Steel common	76⅛	69⅞
U. S. Steel preferred	119¾	118⅝
Western Union	73¾	75
Westinghouse common	72⅛	71½
Westinghouse preferred	120	124

*Last price quoted.

BOSTON.

	Oct. 17.	Oct. 10.
American Tel. & Tel.	138¾	137¼
Edison Elec. Illuminating	262	269
General Electric	154¾	150
Massachusetts Electric common	20¼	19½
Massachusetts Electric preferred	84½	84
New England Telephone	133½	132
Western Tel. & Tel. common	17	18¼
Western Tel. & Tel. preferred	85	88

PHILADELPHIA.

	Oct. 17.	Oct. 10.
American Railways	43	43
Electric Company of America	11⅝	11½
Electric Storage battery common	50½	48
Electric Storage battery preferred	50½	48
Philadelphia Electric	15⅝	15½
Philadelphia Rapid Transit	19	19⅛
Philadelphia Traction	83	83¼
Union Traction	43	43

CHICAGO.

	Oct. 17.	Oct. 10.
Chicago Railways, Series 1	70	65
Chicago Railways, Series 2	17½	15½
Chicago Subway	5¼	4
Chicago Telephone	120	120
Commonwealth Edison	116¾	116¾
Metropolitan Elevated common	20	17
Metropolitan Elevated preferred	69	60
National Carbon common	126	124
National Carbon preferred	119	119

PERSONAL MENTION.

MESSRS. VAIL, BETHELL AND THAYER were recently in Chicago inspecting the plants of the Western Electric and Chicago Telephone companies.

C. B. TURPIN, formerly of Kokomo, Ind., has been made manager of the Salt Lake City, Utah., office of the Postal Telegraph Company.

J. C. MURRAY, sales engineer of the Kellogg Switchboard & Supply Company, has returned from a South American trip and will immediately take up his work in the telephone field.

JOSEPH A. HOLMES, director of the technological branch of the United States Geological Survey, has been appointed by President Taft to the directorship of the newly established Bureau of Mines.

HOWARD D. CARPENTER has accepted a position with the North Shore Electric Company, Chicago. Mr. Carpenter was, for a number of years, an instructor in electrical engineering in the University of Missouri.

C. L. BRAUCHER, general manager of the New Ottawa Telephone Company, of Elmore, O., recently retired. He was succeeded by John G. Steincamp, who is also manager of the Sandusky Telephone Company.

M. NAKASHOJI, vice-minister of the department of communication of Japan, together with S. Uchida and his assistant H. Sujumara were in Chicago this week. The party is making an inspection of American electrical properties.

EDWARD S. MANSFIELD, of the Edison Electric Illuminating Company, Boston, delivered an address on "The Electric Vehicle Proposition" at a recent meeting of the Electric Vehicle and Central Station Association held in Boston.

FREDERICK C. STEVENS, State Superintendent of Public Works of New York State, is a director in the Telephone Improvement Company, which is capitalized at $3,000,000. The principal offices of the Company, which will manufacture telephone supplies, will be at Attica, Wyoming County, where Mr. Stevens resides.

ROBERT H. READ, who for a number of years was one of the editors of this journal, and conducted at that time its patent department, has resumed the practice of patent law at Washington, D. C. Mr. Read retired from the Electrical Review Publishing Company to join the firm of Pope, Read & Rogers, of New York City, of which the late Franklin L. Pope was senior member. Later he joined the patent staff of the General Electric Company. Mr. Read will specialize in electrical and chemical lines of patent work.

C. O. BAKER, the head of the house of Baker & Company, platinum importers and refiners of New York and Newark, accompanied by Mrs. Baker, attended the thirty-sixth annual convention of the American Bankers' Association, at Los Angeles, Cal., traveling on the special bankers' train over the Pennsylvania Railroad. The tour began in New York City on Monday, September 26, and ended at the same city on Friday, October 21. It included a trip from the Atlantic to the Pacific, the convention at Los Angeles, and a visit to all the important cities of the Pacific Coast. Mr. Baker is a director of the National State Bank, of Newark, N. J., one of the strongest and most ably managed financial institutions in the state of New Jersey, and, besides, has other large financial as well as railroad and manufacturing interests.

OBITUARY.

WILLIAM M. STEWART, division equipment superintendent of the New York Telephone Company, died recently at his home in Westfield, N. J. Just before his death he returned from an extended vacation in the Adirondacks and resumed his duties in good spirits and apparently the best of health. Mr. Stewart was forty-four years old, and for the last twenty years had been with the New York Telephone Company. He supervised the construction of many new central offices and did much to develop the telephone art to its present high efficiency. His personality made him a host of friends. He was a member of the Telephone Society of New York and the New York Electrical Society. A widow and son survive him.

NEW INCORPORATIONS.

ELKHART, IND.—The Elkhart Manufacturing Company has been incorporated with a capital stock of $25,000 to manufacture electrical machinery. The directors are Walter Brown, H. A. Albert and H. S. Hubbard.

EL CENTRO, CAL.—The Imperial Valley Electric Company has been incorporated under the State laws, its capital stock being placed at $10,000. J. W. Finch is the president; C. F. Ferguson, secretary, and V. L. Wildermuth, treasurer. The company will manufacture electric fixtures and do a general electric business.

SOUTH BEND, IND.—The National Time Switch Company, capitalized at $25,000, has filed articles of incorporation with the Secretary of State. The object of the corporation is to manufacture and deal in electric time-switches, mechanical time-switches, electric motors, dynamos and other electrical machinery, appliances and supplies. Neil C. Morrison, E. L. Betts and Earl Lindewald are directors. S.

INDUSTRIAL ITEMS.

CROUSE-HINDS COMPANY, Syracuse, N. Y., recently issued Number 4 of its booklet *Condulet Talk*. The booklet contains illustrations of a number of types of condulets and shows their appearance when installed.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., states in the October number of *Trumbull Cheer* that notice of all changes in price in the company's products will be given in that publication.

THE BRYAN-MARSH COMPANY, Chicago, Ill., supplied the Mazda lamps which are being used in the illumination of the new building of the Denver Gas and Electric Company, an illustrated description of which was given in our last issue.

THE ESTERLINE COMPANY, Lafayette, Ind., recently distributed part 1400-D of its perpetual catalog. The booklet gives prices on Esterline graphic meters and also contains descriptions and a number of illustrations of the instruments.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, O., describes its direct-current steel-frame Type F motors in Bulletin No. 391 which was recently issued. In addition to illustrations of the motors assembled and in part, several views of motor installations are given.

THE LOCKE INSULATOR MANUFACTURING COMPANY, Victor, N. Y., recently published "The Insulator Book," containing data on pole and tower-line construction, wire, line-protective devices, etc. Diagrams of a number of shapes of insulators are included as well as a number of forms of towers. The book is made loose leaf so that additional leaves may be inserted.

THE DUNCAN ELECTRIC MANUFACTURING COMPANY, Lafayette, Ind., has issued Bulletin No. 11, illustrating and describing Duncan transformers for lighting and power. The Bulletin is well illustrated and also contains a number of diagrams showing how connections are made for various transformer tests. Directions for making the tests are included in the publication.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, of Pittsburg, Pa., has just issued its "Textile Motor Talks No. 12." The booklet compares the development of the textile type induction motor to that of the automobile. It points out the fact that motor drive is doing in cotton machines what the vehicle motor and vehicle engine have done to the "horseless carriage."

THE NATIONAL CARBON COMPANY, Cleveland, O., has published a handbook on the operation of motor cars and motor boats. This booklet, which is the seventh revised edition of the "Motorist's Handbook," contains many suggestions regarding ignition, which are of much value to motorists. The arrangement of a list of probable causes of engine troubles is such that with it the location of trouble is greatly facilitated.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, Pittsburg, Pa., has just made a distribution of sections for its perpetual catalog No. 3001. There are twenty-four sections in the new distribution covering a wide range of topics. Among the apparatus described are meters, circuit-breakers, arc-lamp accessories, static protective apparatus, switchboards, transformers, series tungsten street-lighting systems, etc.

THE GARWOOD ELECTRIC COMPANY, Garwood, N. J., has published Bulletin No. 505G, under the title "A Revolution in the Newspaper Press Drive." An installation of the motor is shown by an engraving, and two curves are used to show the great power economy obtained by using field control instead of armature control. A full-page illustration of the interior of the shops of the Garwood Electric Company is included in the Bulletin.

THE NATIONAL-ACME MANUFACTURING COMPANY, Cleveland, O., describes and illustrates in a recent folder the "Acme Automatic" multiple-spindle screw machines. These are used not only for the heavy work in railroad shops, but are also applied to the manufacture of delicate watch parts. Illustrations show the appearance of the machines with both belt drive and motor drive, and in connection several companies using Acme machines are listed.

THE BRISTOL COMPANY, Waterbury, Conn., is mailing a new thirty-two page Bulletin No. 126, describing its Class II recording thermometers. A list of users, which is included, shows that these instruments have been used extensively and by widely varying industries. One of the most important uses is the recording of boiler feed-water temperature. An interesting feature of the publication is an actual record of temperature in a sulphite pulp digestor, which is there reproduced for the first time.

THE CLAY PRODUCT COMPANY, Brazil, Ind., has published a bulletin on the subject of vitrified clay conduit. An illustration of the factory together with a view of the dry room gives some idea of the size of this factory. A number of illustrations of different styles of conduit and of the process of installation are also used. In the chapter on inspection considerable information is given which will be of assistance to companies buying conduit for any use. Estimates of cost of construction based on actual conditions and prepared by experienced engineers, are included in the publication.

THE WESTERN ELECTRIC COMPANY, Chicago, Ill., recently distributed Bulletin No. 9,635, describing Hawthorn commercial and folding-type Mazdaliers. Mazdaliers are lighting fixtures which have been developed since the advent of the Mazda lamp and are designed to support the lamp, at the same time providing it with an artistic shade. Besides describing the construction of the Hawthorn type of Mazdaliers the booklet gives a number of illustrations of the various types of fixtures. A portion of the publication is devoted to the anti-jar link suspension which is described as a simple and effective means of protection against any possible jar and vibration.

J. G. WHITE & COMPANY, New York, N. Y., have been awarded a contract by the New York, Ontario & Western Railway Company for the erection of railroad shops at their Mayfield yards, Mayfield, Pa., near Carbondale. The work to be carried out consists of the erection of a ten-stall roundhouse, with a seventy-five-foot turntable, machine shop, carpenter shop, with complete power plant, storehouse, office building, oil building, sand storage, drier and loading house, and a complete coaling station with a storage capacity of approximately 1,000 tons. The buildings will be of the usual type of brick and steel construction. The estimated cost is approximately $150,000.

THE RICHMOND ELECTRIC COMPANY, Richmond, Va., has published and distributed Bulletin No. 13, describing its slip-ring polyphase motors. The majority of the motors made by this company are sold to machine manufacturers and are then resold after they have been made a part of the machine equipment. So great has the demand for these machines become that a full line ranging from one-fourth to seventy-five horsepower, has now been placed on the market. Illustrations of the motor, motor parts and controlling apparatus are shown in connection with the description. Bulletin No. 12, which was mailed at the same time, describes the Company's squirrel-cage induction motors.

THE FORT WAYNE ELECTRIC WORKS, Fort Wayne, Ind., recently distributed to the trade three bulletins describing new electrical machinery and instruments. Bulletin No. 1121, on the Type B direct-current generators shows a number of illustrations of these machines, which are made in sizes varying from one to seventy-five kilowatts. Portable watthour meter calibrators are described in Bulletin No. 1124. This meter provides a very rapid as well as an extremely accurate means of checking service meters. The third publication, Bulletin No. 1125, describes the single-phase induction watthour meter, Type K_s. The company has also issued a valuable instruction book, No. 3043, on this meter.

THE JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., presents in the current number of *Graphite*, a paper on fallacious paint theories. Mr. Sabin, who read the paper before the Society of Chemical Industry, points out the fallacy of making tests with pigments in water and believing them to be applicable to paints made up with oil. The tests made with pigment paste show that lampblack and graphite tend to cause rust and zinc to prevent it, whereas the contrary is true with the pigment when used in paint. The explanation, he states, lies in the effect that no electrical action takes place with the oil paint, but such action is found to be considerable with the paste which is made up with water.

THE GENERAL ELECTRIC COMPANY of Schenectady, New York, has presented the University of Illinois with a recording steam meter, a device which has been in sunccessful use as a means of determining the quantity of steam passing any pipe to which it may be attached. The gift was transmitted on behalf of the General Electric Company by its sales manager, F. G. Vaughen, to Prof. Ernst J. Berg in charge of the Department of Electrical Engineering. This is the second significant gift that the General Electric Company has made the University of Illinois during the past year, the first consisting of a 100-kilowatt Curtis steam turbo-generator which now constitutes a part of the equipment of the department of electrical engineering.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., recently distributed Bulletin No. 125 on the installations of the "Chloride Accumulator" on the system of the Gulfport and Mississippi Coast Traction Company. The unique feature of the installation lies in the fact that three systems of batteries, each operating under different conditions and accomplishing different results, are used on the same line. The first to be installed was a line battery between the two rotary substations; the second was a powerhouse battery; and the third, which has just been completed is a floating battery near the end of the line. In addition to the history of the plants and interesting accounts of the performance of each of the battery systems, the bulletin contains a number of illustrations.

DATES AHEAD.

Illuminating Engineering Society. Annual Convention, Baltimore, Md., October 24-25.

Illinois State Electric Association. Annual meeting, Rock Island, Ill., October 25-27.

Texas Independent Telephone Association. Annual Convention, Dallas, Tex., October 26 and 27.

American Association of Electric Motor Manufacturers. Semi-annual meeting, Chicago, November 14-16.

Alabama Light and Traction Association. Annual meeting, Anniston, Ala., November 21-23.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) October 11, 1910.

972,170. ADJUSTABLE SUPPORT FOR HANGING LAMPS. Herbert E. Drew and William P. Carroll, Portland, Me. Filed April 9, 1910. Comprises a pivoted arm provided with an anti-friction guide, and so arranged as to allow the incandescent-lamp to hang at various distances from the ceiling.

972,209. SWIVELING ATTACHMENT DEVICE FOR ELECTRICAL APPARATUS. John H. Morley, Johnstown, Pa. Filed June 26, 1909. Comprises a terminal-carrying plug, the terminals consisting of an arcuate spring at the side and one or more U-shaped springs at the end of the plug, a threaded metallic sleeve loosely secured to the plug to permit rotation, the sleeve contacting with the side terminal, a body portion consisting of a threaded metallic sleeve electrically connected to one feed wire and a member electrically connected to the other feed wire, that member being in contact with the end terminal on the plug and the threaded sleeve on the plug being engaged by the threaded sleeve on the body portion.

972,210. STORAGE-BATTERY CIRCUIT CONTROLLER AND TESTER. Homer N. Motsinger, Pendleton, Ind., assignor to Motsinger Device Manufacturing Company. Filed Feb. 9, 1909. Includes the combination of a generator, a storage battery, a meter circuit, a meter connected therein, a switch block comprising three terminals, a switch pin formed to connect the terminals in pairs, and connections between the generator and one terminal, between the battery and another terminal, between the meter and the other terminal, and between the meter and the storage battery and generator.

972,240. TROLLEY. Howard B. Potts, Jackson Township, Guernsey County, O. Filed Jan. 10. 1910. There is combined with a wheel-bearing-harp provided with a tubular lower end having a cylindrical opening therein a trolley-pole provided with a ferrule at one end thereof of less diameter than the diameter of the opening inserted therein and provided with a transverse opening positioned in alinement with the apertures. A bolt constitutes a pivot for loosely uniting the harp and pole together mounted in the apertures and extending through the opening in the pole, one end of the bolt being formed to constitute means for connection with a rope for manually manipulating the trolley-pole.

972,248. ELECTRIC HEATING-RECEPTACLE. Walter Richmond, Memphis, Tenn. Filed Feb. 13, 1909. In a double heat-retaining receptacle is provided an electric circuit including series-connected heating coils arranged longitudinally in the space between the sides of the receptacles and transversely across the space between the bottoms and thermostatic means to open and close the circuit; outer and inner receptacles being of inverted frusto-conical form, and the longitudinal coils having their axes in planes radial to the axes of the cones whereby the lower portion of the inner receptacle receives the major portion of the heat.

972,308. ELECTRIC HEATER FOR OIL-WELLS. James E. Williamson, Pittsburg, Pa. Filed Oct. 26, 1908. The heater, which in this device is combined with the pumping tube comprises an outer and an inner shell, and an electric resistance arranged upon the exterior of the inner sheil, the shell constituting the return conductor and the resistance being located in a water-sealed chamber between the shells, the inner shell being adapted to be connected to the pumping tube, and the outer shell having a series of corrugations in its wall.

972,319. CABLE-CONTROLLER FOR ELECTRICAL APPARATUS. René Joseph François Samuel Baron, Paris, France. Filed Jan. 23, 1906. A winding-up device for an electric cable comprises a casing, a hollow vertical spindle within the casing, a winding-up drum for the cable arranged in the casing and loosely mounted about the spindle, a spiral spring arranged in the central chamber of the drum, one of the ends of the spring being secured to the drum and the other to the spindle.

972,329. LOCK-OUT DEVICE FOR PARTY-LINE TELEPHONES. William M. Bruce, Jr., Springfield, Ohio, assignor to the American Automatic Telephone Company, Rochester, N. Y. Filed July

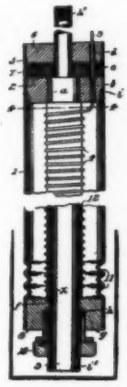
9, 1906. The lockout includes a main switch, a relay adapted to be bridged across the line by the operation of the switch, a talking outfit adapted to be brought into circuit by the operation of the relay, a circuit-breaker to disconnect the talking outfit independent of the relay, and a local inductive circuit through the relay and talking outfit, and means for establishing the inductive circuit when the talking circuit is broken by the circuit-breaker.

972,343. LAMP-SOCKET. John Darby, Summit. N. J. Filed Feb. 3, 1909. The socket includes in combination two opposed heads of insulating material, supports arranged between and connected to each head, a cylindrical controller of insulating material arranged transversely of the socket, a number of conducting pieces symmetrically arranged upon the controller and separated from each other, a line contact supported by one head and a load contact supported by the other.

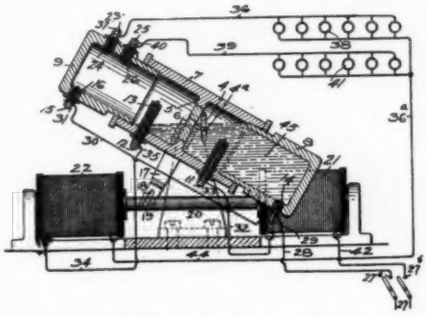
972,353. FIRE-ALARM SWITCH. Poe W. Eskridge, Rutherfordton, N. C. Filed June 9, 1909. A fusible retaining device holds one side of a conducting frame away from a contact, keeping the circuit open. When exposed to excessive heat the alarm circuit is closed.

972,365. ELECTRIC SWITCH. Monroe Guett, Hartford, Conn., assignor to the Hart & Hegeman Manufacturing Company, Hartford, Conn. Filed April 25, 1908. Comprises an escape-plate to which the switch is attached, and which is operated by two buttons.

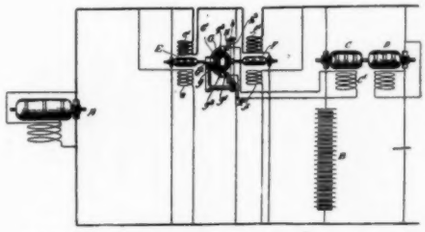
972,387. SNAP-SWITCH. Stanislaw A. Koltonski, Boston, Mass. Filed Oct. 26. 1906. The binding post on the switch has two



972,308.—HEATER FOR OIL WELLS.



972,516.—SIGN FLASHER.



972,536.—ELECTRICAL DISTRIBUTION SYSTEM.

separated contact members and a rotary member carrying a connector bar to enter between said contact members, each being divided transversely to the direction of movement of the connector bar to form a number of sections which are situated to be engaged successively by the connector bar as it rotates.

972,399. ATTACHMENT FOR TELEPHONES. John W. Nilsson, Balfour, N. D. Filed Nov. 16, 1909. Comprises a signaling mechanism, a receiving fork, means operatively connecting the mechanism and fork to set the mechanism for operation, said means operating to set this mechanism upon the depression of the fork, and elements arranged to prevent a second depression of the fork until the signaling mechanism has completed its operation.

972,424. ELECTRICAL RELAY. Lynn A. Williams, Evanston, Ill. Filed July 16, 1909. Includes an electromagnet, a rigid armature lever, a spring contact connected with and forming a load upon this armature, and means whereby the mechanical advantage of the armature is decreased as the armature is attracted.

972,446. FLOOR-DRESSING MACHINE. George F. Hall, Providence, R. I. Filed Aug. 24, 1906. The machine is driven by an electric motor mounted upon it.

972,457. ELECTRICALLY-PROPELLED VEHICLE. Willy Köhler, Bremen. Germany. Filed March 17, 1910. A trackless trolley car has a guide pipe for the trolley cable that is mounted on the front top of the car so that the motorman can swing it into operative or inoperative positions.

972,468. CLOSED SYSTEM OF ELECTRICAL DISTRIBUTION. Roderick M. Palmer, Cambridge, Mass., assignor to George O. G. Coal, Cambridge, Mass. Filed March 1, 1909. The primary circuit is of high voltage and contains a resistance, to a part of which the secondary circuit and an auxiliary circuit are connected.

972,471. INSULATED RAIL-JOINT. Charles F. Quincy, Oconomowoc, Wis., assignor to Quincy, Manchester, Sargent Company, New York, N. Y. Filed March 16, 1908. Between the fishplates and rails are layers of insulation, and also between the base plate and bases of the rails.

972,480. LIGHT-HOLDER. Edward K. Southwick, Newark, N. J. Filed Feb. 24, 1910. Fastened to the lamp socket is a rod containing a swivel joint and terminating in a U-shaped clamp provided with a clamping screw.

972,489. GROUND-CLAMP. Harry E. Adams, Toledo, Ohio, assignor to Monroe Electrical Manufacturing Company, Monroe, Mich. Filed June 28, 1909. A band passes around a ground pipe and has its ends fastened in a saddle to which it is securely held by a screw.

972,495. FOLDING-MACHINE. Walter John Beattie, Cohoes, N. Y., assignor to the Beattie Manufacturing Company of Cohoes. Original application filed May 21, 1908. Divided and this application filed Aug. 15, 1908. A machine for folding collar and cuff blanks contains an electric heating element.

972,512. STARTING-GEAR OF INTERNAL-COMBUSTION MOTORS. Paul Daimler and Alfred Vischer, Untertürkheim-Stuttgart, Germany, assignors to Daimler Motorengesellschaft, Untertürkheim-Stuttgart, Germany. Filed Nov. 12, 1908. Comprises a pump operated by the driver for drawing an explosive mixture through an auxiliary carbureter into the cylinders and igniting it from an auxiliary source of electric current.

972,514. DEVICE FOR BRAKING TRAM-CARS AND ELECTRIC-RAILWAY CARRIAGES. Charles Degoumois, Berne, Switzerland, assignor to Charles Degoumois, Berne, Switzerland, and Sté Seghers et Paradis, Paris, France. Filed June 20, 1908. In connection with a drum-type controller is a device for short-circuiting the motors through a series of resistances, which can gradually be cut out.

972,516. ELECTRIC SIGN-FLASHER. Roger D. De Wolf, Pittsburg, Pa. Filed Nov. 30, 1906. A tilting casing having a number of contacts is partly filled with mercury which opens and closes the lamp circuit as the casing is tilted, and also alternately energizes electromagnets, whose common reciprocating core tilts the casing.

972,526. ADJUSTABLE CASING FOR LAMP-SOCKETS. Edgar H. Freeman, Trenton, N. J. Filed July 28, 1910. Comprises a cap with equidistant lugs having locking shoulders, and a shell provided with positioning slots and a resilience slot opening through one end thereof, the shell presenting a locking abutment at one edge of the resilience slot and contiguous to the latter being provided with an inturned guiding lip engaged by one lug as the other lugs enter the positioning slots in the shell portion.

972,536. ELECTRICAL SYSTEM OF DISTRIBUTION. Albert S. Hubbard, Belleville, N. J., assignor to Gould Storage Battery Company. Filed June 8, 1906. Two constantly rotating compound motors, one differential and other cumulative, operate through differential gearing a rheostat in the field circuit of a booster for a regulating storage battery.

972,538. MAXIMUM-DEMAND METER. Vladimir Karapetoff, Ithaca, N. Y. Filed Nov. 9, 1907. In combination with a wattmeter and means for indicating the maximum demand during a given interval of time is a friction clutch which operatively connects the meter and means; and an electromagnetic device for restoring said means to their initial position and simultaneously releasing the clutch, whereby counter-torque upon the meter is avoided.

972,542. MERCURY-SWITCH. Henry Koch, Rahway, N. J., assignor to the Regina Company, Rahway, N. J. Filed Sept. 11, 1908. Two chambers contain mercury. Two plungers can be thrust into them so as to close the circuit and seal the chambers.

972,560. SPARKING PLUG. Gottlob Honold, Stuttgart, Germany. Filed Nov. 5, 1907. Gives details of construction.

972,577. ELECTRICAL FIXTURE. Frank E. Seeley, Bridgeport, Conn., assignor to The Bryant Electric Company, Bridgeport, Conn. Filed June 17, 1909. An incandescent-lamp socket contains recesses and flanges, so that when the shell and cap are put together the wires are forced into a sharp U-bend, thus preventing their loosening and relieving the tension from the terminals.

972,600. CLEANER FOR THIRD RAILS. Andrew Jackson Cockerell, Chillicothe, Ohio. Filed Dec. 8, 1909. A frame extending from the car has mounted in it a brush and scraper.

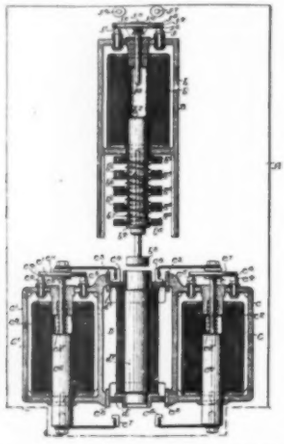
972,613. METHOD OF AND APPARATUS FOR DRAWING GLASS. Robert L. Frink, Cleveland, Ohio. Filed Nov. 9, 1908. A thermostatic device regulates the speed of drawing electrically.

972,615. BAIT FOR DRAWING GLASS. Robert L. Frink, Lancaster, Ohio. Filed May 20, 1909. Comprises a support, a metallic band secured at separated points along one edge to the support, and connections for passing an electric heating current through the band.

972,616. METHOD OF DRAWING GLASS. Robt. L. Frink and Fred J. Fink, Lancaster, O. Filed March 18, 1910. Consists in lowering a bait member into and raising it from a bath of molten glass, and maintaining the glass in immediate contact with the bait, as the latter is raised, by passing an electric heating current therethrough.

972,625. MOTOR-CONTROLLING APPARATUS. Samuel H. Keefer, Plainfield, N. J. Filed July 23, 1909. Combined with a core is a series of rings thereon, springs yieldingly separating the rings, flexible conductors connecting them with a resistance, and electromagnets for moving the core to cause certain rings to successively engage each other.

972,628. CENTRAL TELEPHONE SYSTEM. Albion D. T. Libby, Elyria, Ohio, assignor to the Dean Electric Company, Elyria.



972,625.—MOTOR CONTROL APPARATUS.

Ohio. Filed May 28, 1909. Has a three-conductor cord circuit, the third wire of which has connected to it an auxiliary supervisory relay for controlling the lamp signal and the main supervisory relay.

972,634. ELECTRICAL RELAY. Charles H. North, Cleveland, Ohio, assignor to the North Electric Company, Cleveland, Ohio. Filed Nov. 13, 1908. An electromagnet has a relatively short armature adjacent an exposed pole of the magnet, contact springs and an extended armature lever for operating them, the springs and lever having adjacent points of support and parallel motion in operation.

972,655. BRUSH-HOLDER FOR ELECTRIC CONDUCTORS. Frank L. Sessions, Columbus, Ohio, assignor to the Jeffrey Manufacturing Company. Filed March 8, 1902. Is provided with a slide for carrying the brush, a spring in a recess in the support, and a stem connecting the spring and slide.

972,660. ELECTRICALLY-OPERATED BLOCK-SIGNAL MECHANISM. Royal A. Streeter, Marion, Iowa, assignor to Stotts Signal Company, Marion, Iowa. Filed June 24, 1908. The semaphore is adapted to be moved into danger position by gravity and into safe position by electrical means.

972,671. AUTOMATIC BRAKE-APPLYING DEVICE FOR RAILWAY-TRAINS. Harry P. Zackey, Martinsville. N. Y. Filed June 21, 1909. An electromagnet arranged along the track operates an armature extending from the locomotive and adapted to operate the air-brake valve.

972,675. APPARATUS FOR LIGHTING MINERS' SAFETY-LAMPS. John Cunningham Bowie, Cardiff, England, and John Henry Phelps, Yokohama, Japan. Filed July 11, 1908. The lamps are put into a sealed case in the lower part of which is a manually-driven dynamo for igniting the lamps. The case cannot be opened until the dynamo is stopped.

972,682. ELECTRICAL INDICATOR. Edward E. Craig, Kansas City, Mo. Filed June 16, 1909. An electric selector switch for elevator indicators has a circular series of contact segments each having a rise on its end portion, and a rotary switch lever carrying a yieldably mounted roller adapted to engage the segments.

972,687. BAIT FOR DRAWING GLASS. Robert L. Frink and Fred J. Frink, Lancaster, Ohio. Filed March 10, 1910. A bait adapted to be plunged into a bath of molten glass is connected to the secondary of a transformer which supplies heating current to it.

972,692. MAGNETO-MACHINE FOR USE IN CONNECTION WITH THE IGNITION SYSTEMS OF INTERNAL-COMBUSTION ENGINES. Robert Frederick Hall, Moseley, near Birmingham, England. Filed Aug. 24, 1908. The armature casing has a chambered casting fitted to its end, a high-tension slip ring disposed within the casting, a collector brush for engagement with the slip ring, a casing for the brush, a contact breaker, and a casing for the latter fitted to the end of the casting

972,715. TELEPHONE RECEIVING APPARATUS. Greenleaf Whittier Pickard, Amesbury, Mass. Filed March 16, 1910. Combined with the magnet-and-pole-piece system are line-terminals electrically connected with said system by way of spark-gaps.

972,721. WIRELESS TELEGRAPHY OR WIRELESS TELEPHONY. Octave Rochefort, Paris, France, assignor to Compagnie Générale Radio-Telegraphique Carpentier, Gaiffe. Rochefort, Paris, France. Filed Nov. 8, 1909. Consists of four detectors forming electric rectifiers connected so as to arrange between the earth of the bipolar resonator and the ends of the circuit of the telephonic receiver, a condenser with three contacts.

972,729. ELECTRIC ROTARY FLOOR SURFACING, SCRUBBING, AND POLISHING MACHINE. William H. Strange, Chicago, Ill., assignor of one-half to Robert H. Langston and John P. Sullivan, Chicago, Ill. Filed Sept. 8, 1906. A vertical-shaft motor is mounted on the machine.

972,735. RAIL-JOINT. William P. Thomson and Samuel G. Thomson, Philadelphia, Pa., assignors to Thomson-Thomson Company, Philadelphia, Pa. Filed Dec. 27, 1907. An insulated joint.

972,778 and 972,779. ELECTRIC FURNACE FOR THE CONTINUOUS MANUFACTURE OF GLASS. Marius Sauvageon, Colombes, France. Original application filed Aug. 5, 1909. Divided and these applications filed Aug. 2, 1910. Has a combined melting and refining chamber in which are arranged electrodes immersed in the molten glass.

972,782. SYSTEM OF ELECTRICAL DISTRIBUTION. Justus B. Entz, Philadelphia, Pa., assignor to the Electric Storage Battery Company, Philadelphia, Pa. Filed May 28, 1904. Combined with a main battery and a pilot cell are circuit connections for causing the pilot cell to first become fully charged, means for opposing the effects of the main battery and pilot cell, and devices responsive to these means for interrupting the charge of the main battery.

REISSUE.

13,157. LAMP-RECEPTACLE. Harry Wallace Lawrence, Denver, Colo., assignor to the New England Electric Company. Filed Aug. 26, 1909. Original No. 864,427, dated Aug. 27, 1907. Comprises a porcelain base with an annular groove therein, the groove having a number of outward extensions, and a threaded shell having outwardly bent ears inset in the groove, the ears being received in the extensions.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired October 17, 1910:

506,658. MULTIPLE COMMUTATOR APPARATUS FOR TELEPHONE SYSTEMS. Louis A. Berthon, Paris, France.

506,683. JUNCTION BOX FOR ELECTRIC CABLES. Samuel B. Fowler, Chicago, Ill.

506,729. ELECTRIC PUSH BUTTON. Benjamin F. Rex, St. Louis, Mo.

506,733. MANUFACTURE OF ELECTRIC LAMPS. Hermann Schulze-Berge and Franz G. A. Schulze-Berge, Brooklyn, N. Y.

506,740. DYNAMO-ELECTRIC MACHINE. Sidney H. Short, Cleveland, Ohio.

506,774 and 506,775. DYNAMO-ELECTRIC MACHINE. Fritz A. Feldkamp, Newark, N. J.

506,786. ELECTRIC LOCOMOTIVE. Hosea W. Libbey, Boston, Mass.

506,830. INSULATED ELECTRIC CONDUCTOR. Leonard F. Requa, New York, N. Y.

506,841. ELECTRIC ALARM SYSTEM. George F. Bulen, Bayonne, N. J.

506,881. REGULATOR FOR DYNAMO-ELECTRIC MACHINES. Jeremiah Keller, Canton, O.

506,883. VISIBLE SIGNAL. Frederic S. Perrin, New York, N. Y.

506,884. APPARATUS FOR SUPPRESSING TELEPHONE DISTURBING-CURRENTS. Frank A. Pickernell, Newark, N. J.

506,890. ELECTRIC-ARC LAMP. August Utzinger, Nuremberg, Germany.

506,920 and 506,921. SYSTEM OF ELECTRICAL DISTRIBUTION. Cyprien O. Mailloux, New York, and William S. Barstow, Brooklyn, N. Y.

506,936. ELECTRIC SYNCHRONIZER FOR CLOCKS. Henry S. Prentiss, Elizabeth, N. J.

506,993. ELECTRIC RAILWAY CONDUIT. Henry H. Franklin, Brooklyn, N. Y.